APR 23 1923

Electrical World

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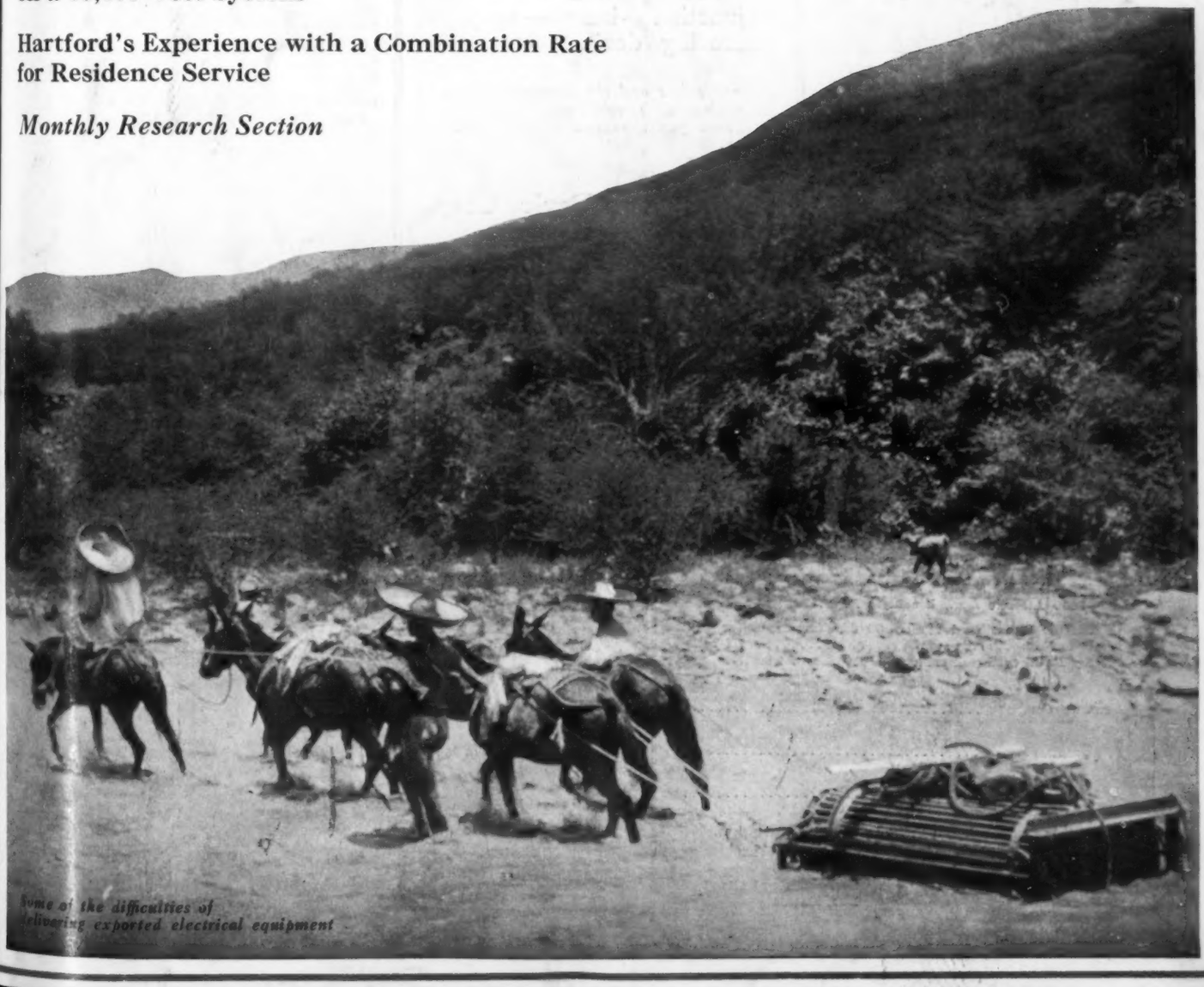
Distribution in Export Trade

Experience with Carrier Current Telephony in Pittsburgh

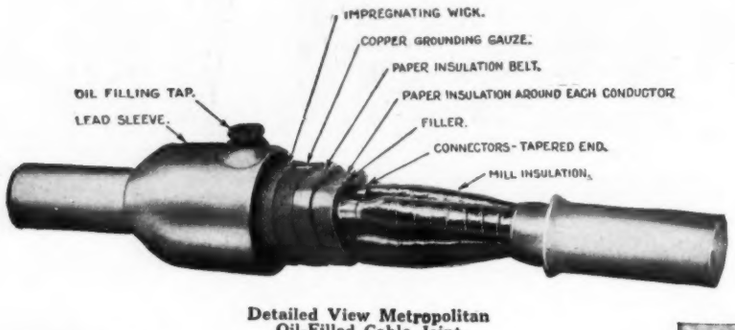
Construction, Operation and Repairing on a 66,000-Volt System

Hartford's Experience with a Combination Rate for Residence Service

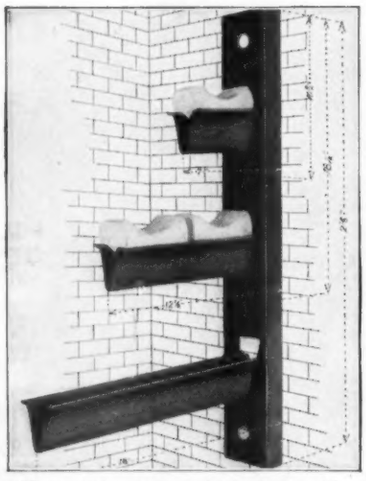
Monthly Research Section



Some of the difficulties of delivering exported electrical equipment



Detailed View Metropolitan Oil-Filled Cable Joint



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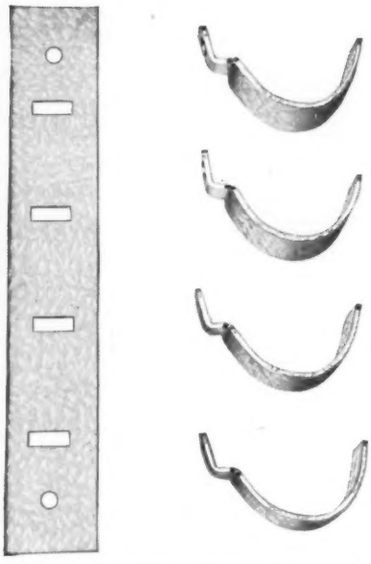
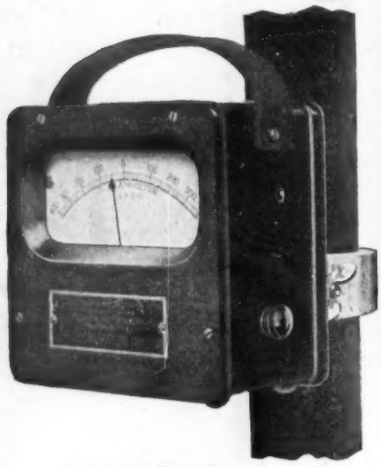


Cable Rack and Hooks Heavily Galvanized



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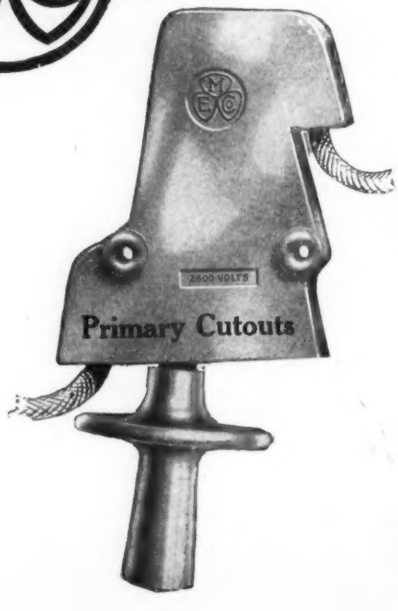
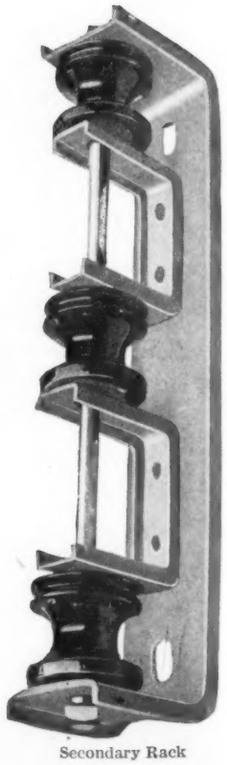


Primary Cutouts



Secondary Rack

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W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

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Thinking Ahead

GOOD fortune has played a large part in the prosperous development of the electrical industry. Steam and electric railways and gas companies have all seen slumps come in the market for the services they render. But there has been no setback in the demand for electric light, heat and power. There may not be for many years. The convenience, the flexibility, the adaptability and the cheapness of electrical service are the reasons.

But the electrical industry cannot be content to await expansion and progress through the influence of accident or fortunate environment. The great majority of men attain their position and prosperity through sheer merit, the constructive application of their brains and imagination. And so it is with an industry. It must plan and promote its evolution as well as concern itself with the activities of the day.

There are tremendous possibilities for service and achievement in the electrical industry. Problems and opportunities of the past are overshadowed by the problems and opportunities of the future. But, just as truly, the possibilities for disaster are equally tremendous if the fabrication of the great structure which the future will reveal is left too much to chance or unsound thinking.

Today's problems of engineering, operating and financing electric power systems are absorbing. And there are questions of public relations, of selling equipment to present customers, of wiring buildings, now at hand. But these activities are actually preparatory. The great conceptions of complete water-power development, of fuel utilization at the mines for conversion into electric power, and of great interconnected superpower systems that will serve the entire land at maximum efficiency—these are all preparatory.

History will some day write the record of this industry in terms of the service which electricity has rendered to mankind, its contribution to civilization. It will list the complete electrical equipment of industry, of the home and of the farm and the establishment of universal communication as its great achievements. These are the objectives—toward them there should be the best constructive study and thinking. Whether it is in power generation, transmission or distribution, in finance or in merchandising, there are many large problems which should be clearly formulated, the proper solution to which will have an all important bearing on the future realization of today's hopes. Even though in the midst of present pressing problems, specific and co-ordinated study of the problems connected with the future's structure should be energetically pursued. Definite planning ahead even ten years would be a great advance. No more important work can be done by the industry's organizations if the work of today is to build adequately and soundly for the future.

Charles Leo Eidlitz

A successful and prosperous electrical business man who has devoted himself for years to the betterment of the electrical contractor.

THE progress of the electrical industry has been achieved locally. Great central power stations may serve broad areas and scattered populations, but it is in the homes and business places of the communities that new and more applications of electricity are effected and that actual industry growth is realized. The electrical contractor —the man who wires buildings for the introduction and the use of electric service—is therefore an important element to all the industry. All are greatly concerned that he should prosper and expand. No man in the country has done more or is doing more today, however, to mold this contractor into the better instrument needed for the advancement of electrical progress than Charles L. Eidlitz, recently appointed a special commissioner to act as the Judge Landis of the electrical contractors of New York.

Mr. Eidlitz has had an interesting and useful career. Born in 1866 in New York City, he came to manhood just at the time when the first popular wonders of electricity were unfolding. While a student at Columbia he decided to become an electrician and joined the old Bergman Electric Works. From there he shifted to the Edison Machine Works when Edison and Sprague were carrying on their experiments there. Then he became inspector of installations for the Edison United Manufacturing Company and then joined the Edison Wiring Company.

With two others he later organized an independent contracting company which he acquired in 1889 and renamed the Charles L. Eidlitz Company. This company he developed into an exceedingly prosperous business. In 1913 he turned it over to his employees. Meanwhile he had also become interested in manufacturing and general sales through the purchase and expansion of the Metropolitan Electric Manufacturing Company and the Charles E. Corey Company, of which he is now head.

Mr. Eidlitz has devoted a large amount of time and effort to trying to make a better business man of the electrical contractor. In 1892 he organized the first local association of electrical contractors in America. Shortly afterward he helped organize the first state association of contractors and in 1901 was the first president of the National Association of Electrical Contractors.

Editorial Comment

Electrical World, April 21, 1923

Volume 81 Number 16

Right to a Reasonable Return Again Upheld

THE decision of the United States Supreme Court in the case of the Public Service Commission of New York vs. New York Telephone Company serves again to remove from ambiguity and doubt the right of a public utility to appeal to the federal courts for relief from rates deemed by it to be confiscatory. It was the contention of the Public Service Commission of New York that the utility, instead of applying to the federal courts for an injunction, should first have asked the commission to reopen the hearings and in case of a refusal an appeal should have been taken to the state courts. That it was not necessary under the law as it exists for the utility to apply to the commission for a rehearing before resorting to the federal courts was very clearly set forth by the Supreme Court. The decision of the court, which was unanimous and reaffirmative of the right of a utility to a fair and reasonable return on its investment, should once more set at ease the minds of commissions, utilities and the public on a point which cumulative decisions have definitely removed from the realm of peradventure.

America Not Alone in Rural-Service Problem

THE facilitation of the use of electrical energy in agriculture is not exclusively an American problem. The technical press of other countries contains editorial and contributed articles that, with a few changes in phraseology to conceal the locality in which they were written, could be published in the United States without a suspicion that they were not written to describe our own conditions.

The English technical press is discussing the problem of how to finance farm lines when the rural use of energy as compared with its urban use is so small. Fear to put the rates at a point which will make the service stand on its own merits is exhibited, and the lack of equipment and methods which will allow the farmer to use a large volume of energy is apparent. The French government is reported to have provided one-third of a huge subsidy, the other two-thirds of which is to be provided by agricultural organizations. With this sum the necessary distribution lines to afford service to French farmers will be built. Germany and the Scandinavian countries are also wrestling with the rural-service problem.

All this indicates that agriculture in the civilized world is looking to the electrical industry for some of the help that electricity has already given industry in general. No one as yet knows just how that help is to be given; but every one who has given the movement careful thought knows that if the help shall be forthcoming, it will mean a real revolution in agricultural production methods. American agricultural engineers of standing take the position that a proper development of the use of electrical energy on the farm will be the biggest step forward that agriculture has ever taken, because it means bringing home to the farmer the importance of the entire farm-power problem as a factor in more economical production. These men point out that, with human labor costs constantly rising and with living conditions on an ascending plane, the problem of the farmer, like that of the manufacturer, is to increase the productive ability of the human worker by taking from him the tasks that mechanical equipment can accomplish much more economically so that he can devote his time to keeping machines at work.

It is the old industrial question of labor-saving machinery in a new guise, and the electrical industry is being urged to solve the problem because of the part it has played in solving the same problem for other industries.

New Two-Rate System Brings Desirable Results

THAT a form of rate for residential service containing a fixed charge for which the customer receives no energy cannot be made successful is a pet hobby which many central-station men have ridden for years. Attempts to hide the fixed costs by spreading them over the first units of energy consumption have been made, and, to protect the utility from loss due to the consumer who refuses to use enough energy to return to the company its fixed costs of service, some form of minimum charge is usually imposed. Most of these methods seem to have been unproductive in the way of the development of energy use on the part of the consumers, and on many systems, particularly the smaller central stations, they seem to have created a large body of consumers who are not carrying their fair share of the costs of service. In one way or another the deficit is made up at the expense of other classes of consumers.

That the problem can be successfully attacked in another way is rather strikingly indicated by the experience of the past year at Hartford, Conn. A rate consisting of a flat charge for which no energy is given, plus a low energy rate, was substituted for a straight-line meter rate that apparently did not encourage an increase in energy consumption among residential consumers. The new rate is of a form that has been used before in other communities; that is, nothing absolutely original in the way of rate structure is claimed. But that the new rate has been successfully "put over" to supersede an old 10-cent flat rate is indicated by the fact that after a year's trial less than two-tenths of 1 per cent of the residential customers asked to go back to the old form of rate, restitution of which was promised by the company if the consumers requested it at the end of the year. The manner in which this result was obtained was a triumph of

diplomacy. The curve of increased consumption shows a better shape than under the old rate.

The big lesson in the situation is the way in which it was handled. Nothing mysterious was attempted—just plain, straightforward laying of the cards on the table on the assumption that the people of the community were competent to judge the merits of the whole proposal. Judicious and continuous effort to show the consumers how to use the new rate form profitably to themselves is the other half of the story. No politics, no sleight-of-hand or back-room work—just plain, straightforward business.

The question of a proper residential rate is still, after all the years of experience and experiment, an unsettled one. Other things being equal, the simpler the rate, the better. While Hartford's new rate is not the simplest possible, yet the experiment is illuminating and the story is worth careful study on the part of central-station executives plagued with the problem of a large body of consumers who are not using the energy they can afford and who are deterred by rate forms that impose a penalty for increased use rather than encourage it.

Refinements Worth While in Hydro-Electric Plant Design

THE more one studies hydro-electric plant design, the clearer it becomes that this is no work for the "catalog engineer." This conclusion is not based upon recent advances in prime-mover development, striking though they have been. What might be called the structural side of water-power installations is receiving increased attention from engineers as well as the problems connected with the selection and regulation of generating units, and it is a question whether utility executives in general appreciate the refinements which are now considered essential for analysis by competent technical minds charged with the task of conserving water for efficient use in electric systems.

Old as the development of water power by the use of dams and reservoirs is, there are many unsolved problems here. Off-hand judgments as to the type of dam best suited to particular cases have no place in the budget of a modern hydro-electric installation. The most skilled engineering opinion is essential upon such points as the allowance to be made for upward pressure, the design of waste gates, the provision for automatic, non-automatic or combination flashboards, and the desirable shape of intakes, scroll cases and rack sections. These may be the problems of the civil engineer, but electrical and mechanical men should also consider them in station development and be prepared to discuss them intelligently in striving for a well-balanced layout. There is a growing consensus of opinion that the sheet of waste water discharged over the crest should be closely conformed to the down-stream surface of a dam, for aside from the possibilities of increased erosion where there is a gap between the dam and the water, in some cases lately mechanical disturbances to neighboring windows and buildings have been noticed which should be eliminated. Operating difficulties arising from improper gate design may become very burdensome, and more attention should be paid to obtaining high-quality castings, anchor bolts of tested material, stop-log slots of fabricated shapes of adequate dimensions, duplex gate stems and sectionalized runways around headworks and forebays. In many instances the ordinary commercial sizes of channel irons are too thin for the best results in stop-log guides, a plate and angle design giving more reliable service. It is an expensive and difficult job, as a rule, to repair submerged structures.

From the intake at the dam to the tailrace, hydraulic experts are studying the shape of all water passages with intense interest. Even the cross-section of trash-rack bars is being analyzed, and in some jobs rounded corners and even special shapes to reduce friction losses are now specified. It may seem meticulous to put high-priced time upon such a question as the desirable angle between the axes of rack bars and the line of advance of the water stream in taking off, for instance, a lateral discharge from a canal to penstocks or wheel inlets; but in a large development with restricted storage facilities all reasonable means of obtaining more kilowatt-hours annually must be weighed. Hydraulic losses in general increase as the square of the water velocities, and there is some danger that engineers whose experience has been confined chiefly to waterworks practice will fail to realize the increased quantities and speeds involved in hydro-electric development work, if they do not get the power-plant viewpoint when undertaking such developments.

These and many other considerations bearing directly upon the convenience, safety, reliability and efficiency of operation emphasize the need of expert design in water-power developments of any real magnitude. It is unfortunate that the men who put their money into hydro-electric developments are seldom in a position to appreciate the difference between good and poor engineering. In a steam plant the fuel rate per kilowatt-hour and other running expenses are, to a considerable degree at least, indices of designing ability. In a water-power plant the designer often can "take it out on the river" if things fall far below expectations. The time is coming, however, when hydro-electric station operations will be more accurately compared than has been done in the past. From this time forward it should be more and more appreciated that hydro-electric design is no field for the amateur or faddist to enter.

How Far Should Organization Work Be Carried?

ORGANIZATION is the keynote of the age, and present-day civilization could not continue without it. Our own industry is a wonderful illustration of what co-operative work can accomplish, but is it not time to define the limits of organization as an effective tool, taking central-station personnel as a case in point? Confining the inquiry to the formation of associations of electrical men in utility ranks, how far down the line is it expedient to encourage regional meetings of employees of different companies, either as branches of national societies or as groups of men trained along particular lines who gather from time to time to exchange views? The industry is thinking about this, at least in some quarters.

Perhaps it is too soon to do more than feel the way along toward conclusions which are adaptable to many situations, but which may not fit all. It seems obvious that real executives, department heads and leading assistants gain almost beyond measure from participation in national and local organizations honestly devoted to service and mutual improvement. So do specialists like power-sales engineers. Through regional organization operating employees classed as chief load dispatchers have become really acquainted as men; they have visited other systems and listened to and discussed

papers of marked educational value. Likewise the benefits of company sections of the National Electric Light Association to the rank and file of employees, men and women, are well established by experience. The point now under consideration, however, is whether corresponding regional organizations of boiler-room foremen, line and underground foremen, storekeepers and chief inspectors are likely to yield correspondingly good results. Opinions differ here, and perhaps no sharp line of demarcation exists between what is clearly worth while and what is doubtful in returns to individual utilities. One thing, however, is vitally important—control of programs within the zone of practical topics.

On some systems foremen of this or that department can rarely be spared to attend outside meetings. Their superiors can get away because construction and repair work go forward at normal speed during their absence. Here is a pretty critical test of prospective success. In some circles it is believed that the good things brought out at meetings and conventions can be brought home and put into use by the superintendents, engineers and other executives who can be spared, without the necessity of drawing upon the "top sergeants" of the industry and slowing down their important and pressing work. On the other hand, if a well-run meeting is attended by subordinates who stick close to business and do not turn the occasion into a base for the exploitation of labor issues, much good may result. Meetings of foremen inside a single company have been known to bring out admirable results in maintenance work, but less experience has been had with such gatherings involving companies under different managements. If there seems to be no categorical answer to the inquiry as to the desirable limit of such organizations at present, it at least serves some purpose to put the question. The crystallization of opinion upon it is much to be desired.

Large-City Distribution an Increasingly Serious Problem

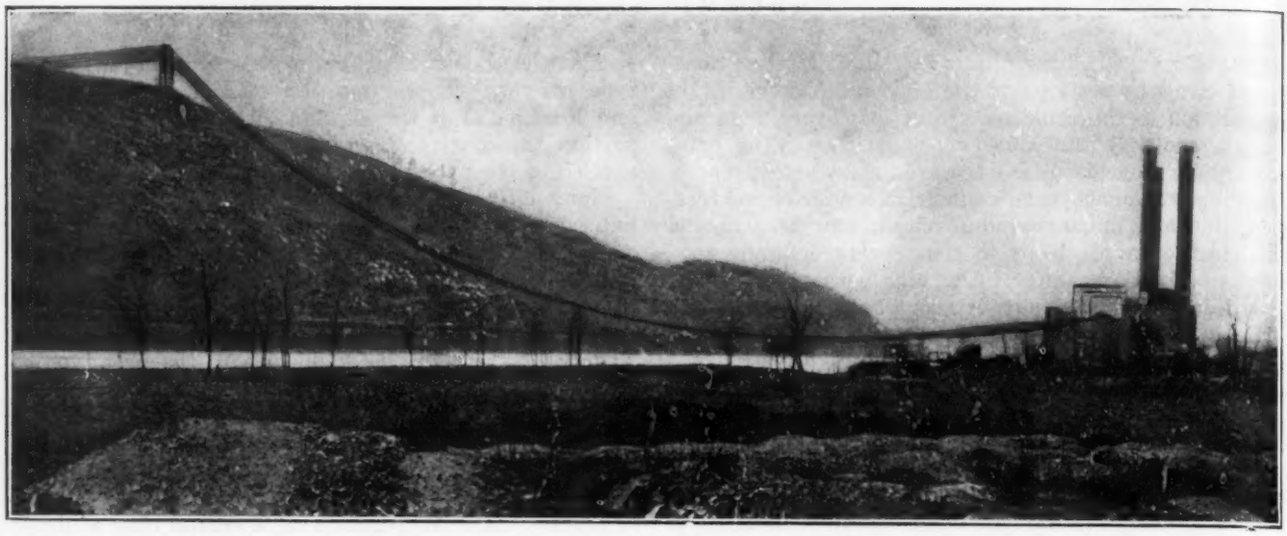
EVERY large generating station is a source of pride to its owners and operators. None the less, it is rapidly becoming recognized that it is impossible to care for the increased demands for electric service simply by building new stations and pouring their energy into the existing distribution systems. It has become necessary, particularly in the large cities, to rebuild and redesign the distribution systems both to care for the load and to gain greater economies in operation, because little real engineering or executive thought was devoted to a study of distribution practice during the rapid development of electrical service, and in most cases the distribution system that exists today is a hodgepodge of inadequate installations that have developed through the expediencies of the moment.

The enormous increase in the load density and the restrictions placed upon distribution by high costs, congested city streets and industrial and domestic demands for 100-per-cent-perfect service have made it necessary to study this problem with foresight in order to secure a system adequate for present and future needs. It has become necessary to look ahead ten to twenty years in laying out these new distribution systems. Any real study involves the growth in load, its location, the possibilities for overhead lines, the possibilities for underground lines and the possibilities for increasing the voltages. Each of the large cities has a distinctive environment and local load conditions such that no general solution can be applied. But some fundamental similarities exist in regard to general conditions as to type of city, general location of industrial districts and location of power stations with respect to loads, so that the constructive work of some utilities can be applied to the problem in other localities.

Many cities have grown uniformly about a central hub with industrial loads distributed almost uniformly around the periphery. Among these are Pittsburgh, Canton, Detroit and Buffalo. Still other cities have the industrial districts distributed radially along the railroads or watercourses—Cleveland, for example. Typical of the solutions applicable to the first type of city are those applied to the distribution problem in Pittsburgh and Detroit. In Pittsburgh a double-circuit overhead 66,000-volt steel-tower line has recently been installed as a ring about the outskirts. Upon this ring are transformer stations for feeding a unit group of loads. Inside the major ring a second ring of lower voltage is contemplated and secondary tie lines will be used to interconnect the several substations and to afford a two-point supply to each load. Detroit is completing the installation of a 120,000-volt overhead line in the form of a half circle about the city with a power supply from the Trenton Channel and Marysville stations. Transformer stations for radial group feeding will be erected on the transmission line, and secondary tie lines will be used to secure interconnection and a two-point supply to all large loads. In Cleveland, where the industrial districts are radially located, underground and overhead radial feeders with tandem substations will be used. Tie lines will be used to secure interconnection and a two-point supply to the larger loads.

In each of these solutions many vexatious problems are encountered. Using the overhead-ring system, difficulty is encountered in securing a right-of-way at a reasonable cost and, if the city grows, public sentiment may eventually force the removal of the line. Moreover, technical equipment for locating and isolating trouble, controlling voltage regulation, maintaining power-factor adjustments and automatically operating the transformer stations is not yet developed to a sufficient extent. In the radial system similar technical problems are encountered, and among these the high-voltage cable problem is of major importance. Underground systems are expensive and the carrying capacity of the streets is limited. Interconnection of substations is difficult and relays are not yet developed satisfactorily to secure the isolation of trouble under all circumstances. Operating engineers are not yet fully satisfied that oil breakers of ample rupturing capacity have been developed to work on any system with huge power stations behind it, and the development of control apparatus must proceed until it is satisfactorily sensitive.

The technical ability of the engineers in the industry undoubtedly will solve the detail problems and develop adequate equipment. But an organized and co-operative educational campaign is needed to obtain results along other lines which are equally important. The public must be convinced that high-voltage overhead lines are safe and reliable; the public must be educated to see that a steel-tower line, if artistic, can be viewed with pride instead of horror; it must learn that the right of eminent domain is essential if costs are to be reduced, and it must be made to appreciate that good service results from the use of expensive equipment and installations and that these are possible only if the operating company receives a reasonable return on the investment.



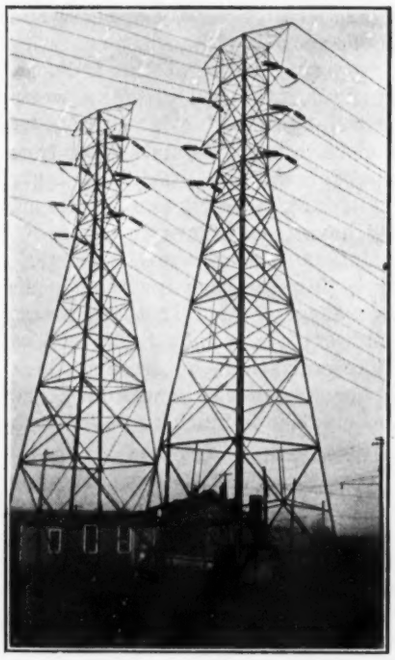
Construction of the Pittsburgh Ring

THE Duquesne Light Company has solved its distribution problem by building a 66-kv. overhead transmission line around the city of Pittsburgh. The hilly country, congested industrial districts and the rivers presented very difficult construction problems.

Upper view — A 2,300-ft. span across the Allegheny at Colfax has 600 ft. difference in the elevation of the supports.

Central views—Double-circuit steel towers 60 ft. high are spaced on an average 7.76 per mile. Many towers were located on steep hillsides.

Lower view—Automobiles, horses and men assembled preparatory to a day's work on the line. Power apparatus was used in stringing wire wherever possible.



Construction, Operation and Repairing on 66,000-Volt System

How the Duquesne Light Company Employs and Maintains Its 80-Mile Central-Station Bus Surrounding Pittsburgh and Fed from Its Brunot's Island and Colfax Power Houses

By IVAN BUYS
Chief of Operation Duquesne Light Company, Pittsburgh

WITHIN a radius of 20 miles of the confluence of the Monongahela and Allegheny Rivers, which form the Ohio, there lies the great industrial district whose heart is Pittsburgh. Power is in demand in large quantities, and the energy supplied by the Duquesne Light Company is playing a large part in making the widely quoted epithet "Smoky City" a misnomer.

The transfer of power from the power houses to the substations which step the voltage down for distribution to customers is accomplished by a 66,000-volt ring entirely surrounding Pittsburgh. Two principal stations, Brunot's Island and Colfax, feed this power ring, which has also been called an 80-mile central-station bus. Each 66,000-volt line can be sectionalized at any ring substation with oil circuit breakers controlled by the relays used for transmission-line protection.

The double-circuit steel towers average 60 ft. in height, although special locations have required the use of 200-ft. towers. The spacing of the towers averages 7.76 per mile; however, the more recently constructed sections tend toward fewer towers per mile and longer spans. The rugged topography of the territory covered has lent itself admirably to long spans with large sags and adequate clearance from ground.

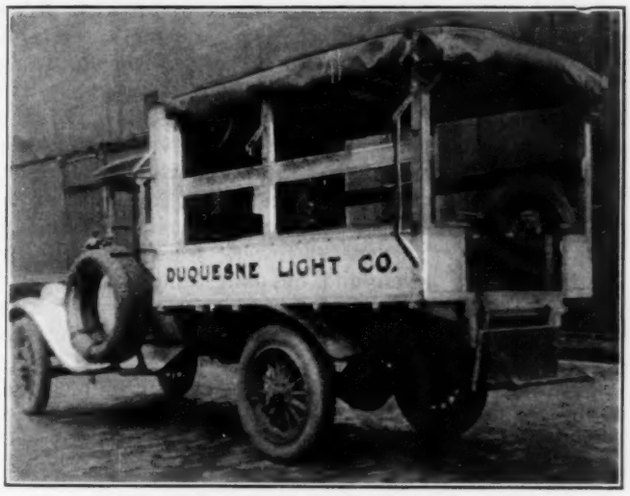
The longest span on the ring is the crossing over the Monongahela River at Duquesne, which is 2,305 ft. The second longest span (2,230 ft.) is the crossing over the Allegheny River at Colfax, with a difference in elevation of supports of 600 ft. A number of other spans are above 1,700 ft.

Very few tangents of an appreciable length were possible because of the many right-of-way difficulties, which proved serious owing to the high value of property in the district. This condition, together with the long spans, has necessitated about 48 per cent of the towers being of dead-end or strain type.

The type of construction known as semi-tension is not used, although a number of combination strain and suspension towers are found. The combination tower is used on small angles. The pull on the inside of the angle gives the wire a tendency away from the tower, and a suspension string of insulators is used. The outside wires are held with strain strings to counteract the pull toward the tower.

Both Copper and Aluminum Used

The distance of 81.4 miles around the ring is divided into 66.1 miles of No. 4/0 copper line and 15.3 miles of No. 4/0 equivalent steel-reinforced aluminum line. A spur of two-circuit line which feeds the Beaver Valley District through the Junction Park substation is copper. The aluminum wire is on the most recently built section of the ring, and it has not been in service long enough to allow a comparison of the operating records of the two kinds of wire. The cost of installing the aluminum wire was higher than the copper, and special tools were required for its installation.

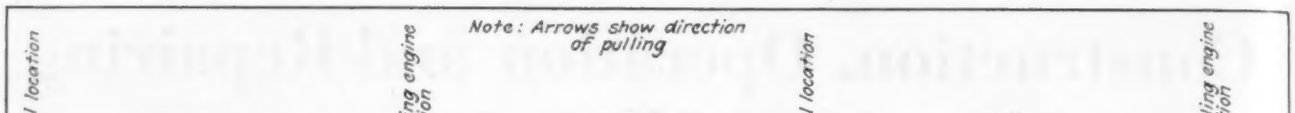


LINE TRUCKS ARE DESIGNED FOR QUICK TROUBLE SHOOTING

Ground wires of ⅜-in. steel were used around the ring. The greater portion was copper-clad steel, although on the most recently built sections galvanized-steel strand was used. On the older portion of the ring five insulator units were used on suspension strings and six on strain strings. Because of trouble which developed from flashovers during lightning storms six units on suspension and seven on strain were used on the newer portions of the line.

Wide differences of opinion are held by operating engineers on the advantages of arcing horns for the protection of insulator strings. In an effort to obtain some comparable data on a large scale, arcing horns on some sections of the ring were placed on the insulator clamps only. On other sections horns were also placed on the towers to form a discharge gap shunting the insulator units, and on still other sections no horns were used. Operating records are not yet complete enough to allow a judgment of their effectiveness.

The towers were of the rigid type, weighing from 5 tons to 6 tons, and all standard towers were galvanized. A few special towers were painted. Towers at corners and at points of unusual strain, such as river crossings, were bolted to concrete bases. The majority of the towers were anchored to a grillage of steel about 4 ft. square and buried to a depth of about 8 ft.



SEQUENCE OF OPERATIONS IN STRINGING WIRE ON THE SYSTEM

On a considerable portion of the territory served by the Duquesne Light Company coal is found in veins which crop out on the surface or are but a few feet below the surface. On several proposed tower locations the coal rights were purchased to prevent possible weakening of the foundations by the removal of the coal. At one location old mine entries were under the only available tower site and forced the building of foundation piers through the workings.

The average 6-ton tower was erected by a five-man gang in one day. Several towers were built in the record time of seven and one-half hours each. The towers were erected piece by piece, with two men and a foreman on the ground and two men working on the tower.

The only special equipment consisted of a piece of 2½-in. double-strength gas pipe 22 ft. long which was used as a gin pole to raise the corner angles. Later the gin pole was used as a boom on the partly erected tower to aid in hoisting additional steel work.

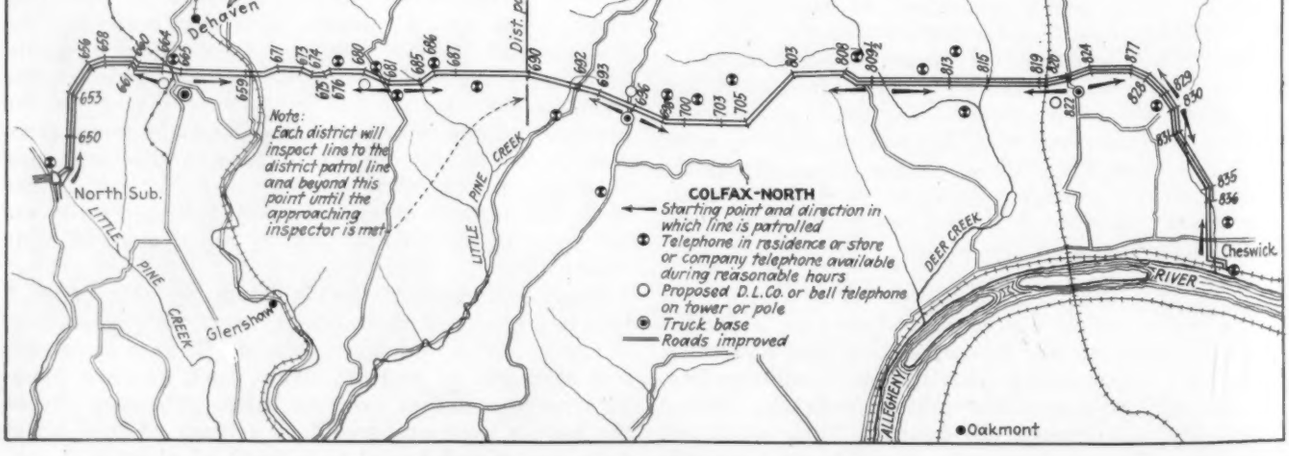
STRINGING OF WIRE

The many railroads and the excellent highway system in the vicinity of Pittsburgh were of advantage in placing the structural steel, wire and insulators at easily accessible points, but became a liability during the wire-stringing operation. The problem of stringing wire with safety and without interruption to public carriers, other wire lines or the orderly progress of the job required the exercise of much ingenuity. It was found that the best results were obtained by first threading ropes in one-half-mile lengths through snatch blocks on the towers. The wires were then attached to the rope and half-mile sections of wire were pulled in, making the ropes available for the next pull.

The ropes were strung by the aid of a team of horses and in exceptionally difficult places a gasoline tractor of the endless-tread type was used. The tractor also hauled material to points inaccessible to trucks and sagged the wire. The tractor's part in the sagging of wire will be discussed in detail in another part of this article.

A gasoline engine was used for pulling the wire. The engine, which was of 6 hp. capacity, was geared to two "niggerheads" which made pulling speeds of 500 ft. and 200 ft. per minute available. A skid mounting proved sufficiently portable, and the engine played a large part in the speedy stringing of the wires.

All of the motive equipment used in the stringing of the wire is shown grouped with a field headquarters on page 904. The completion of a half mile of two-circuit lines per day, which included the stringing of wire, the hanging of insulators and sagging and securing the wires, was achieved by the construction gang, which averaged thirty men. This record was made possible through the organization of the work. Constant communication by telephone was maintained at all times between the reels of wire, the pulling engine and the sagging gang, which were separated by distances varying from one-half mile to one mile. The telephone communication was established with a telephone twist laid on the ground and terminating in field test sets


Scale, Feet
0 1000 2000 3000
Dist. patrol line
BLUE RUN
Dehaven
North Sub.
Glenshaw
LITTLE PINE CREEK
PINE CREEK
DEER CREEK
ALLEGHENY RIVER
Cheswick
Oakmont
Note: Each district will inspect line to the district patrol line and beyond this point until the approaching inspector is met
COLFAX-NORTH
Starting point and direction in which line is patrolled
Telephone in residence or store or company telephone available during reasonable hours
Proposed D.L.Co. or bell telephone on tower or pole
Truck base
Roads improved

MOBILIZATION POINTS FOR HANDLING TROUBLE

and signal bells or horns. The telephone line was installed before placing the pulling engine or wire reels at their locations.

A variation from this method of communication was required on a 30-mile portion of the line. One circuit was installed at the time of erection of the towers, and when about six years later the second circuit was being installed load conditions were such as to require the first circuit to carry load during short periods of emergency. Since, as a safety measure, no wire was strung when this circuit was alive the problem of constant communication between the system operator and the foreman of the construction crew was acute. It was solved by connecting the field-construction telephone circuit to the private lines of the company using the idle 66,000-volt wires as telephone conductors. Temporary connections at the nearest substation from the 66,000-volt wires to the telephone line were established and removed by the substation operator, acting under orders of the system operator.

Elaborate precautions and checking were necessary to insure against the line being energized before the temporary telephone connections were removed, but the results obtained justified the trouble. In one case the line was carrying load thirty minutes after the system operator, through the medium of this hybrid telephone line, ordered the construction foreman to stop work and clear up the line.

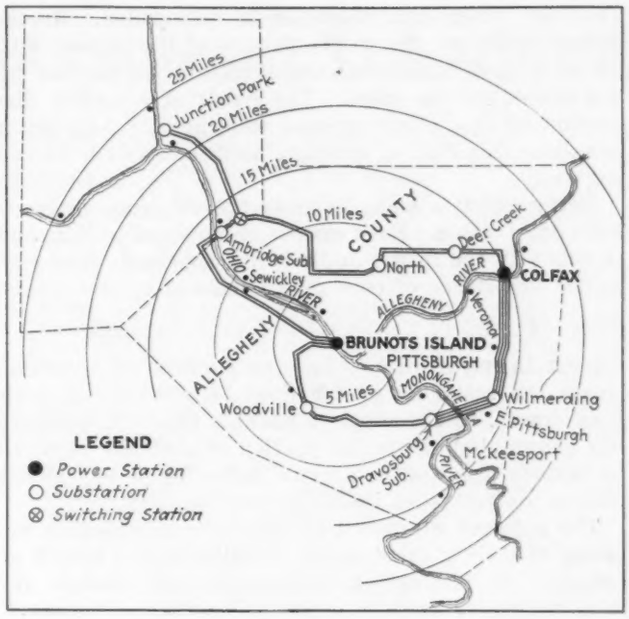
Gasoline Engine Used to Pull Wire

Often a half-mile section of wire was pulled through the snatch blocks on the towers in eight minutes. This result was obtained by the constant communication maintained between the foreman and men at the reels and the engine. Linemen were stationed on each tower to insure the smooth and uninterrupted movement of the wire, and snagged wires and kinks were seldom encountered. After the wires were pulled through and the gas engine was disconnected, the tractor pulled the wires up to sag position with one operation without the use of intermediate rope blocks.

The time saved in sagging the wire in this manner as compared with using a team of horses and several successive hitches through one or more sets of blocks can readily be appreciated. The sag was determined from charts furnished to the construction foreman, and sag marks were painted on the towers by two men who worked ahead of the construction gang. A telescope clamped to the tower leg verified the sag, which was required to be accurate within 6 in.

A material man, aided as required by men from the stringing gang, hauled all material and tools to the best locations. He preceded the gang and located telephones, temporary storage houses for material and the best routes from point to point on the line. He interviewed property owners and secured permission for the necessary trespass on their property. Representatives of the real-estate department were called upon to settle claims which the material man was unable to satisfy. As the stringing gang moved forward the material man inspected the line, arranged for the collection of all scraps of material or tools left behind and the repairing of any damage to property caused by the gang. The construction foreman, who was relieved of these details, was enabled to devote his entire time to speeding the progress of the work.

Inspectors or patrolmen who walk the entire transmission ring once each week are familiar with the



66,000-VOLT TRANSMISSION SYSTEM OF THE DUQUESNE LIGHT COMPANY FORMS AN 80-MILE RING

standards of operating condition to be maintained. They report things varying in importance from serious landslides, dangerous trees and broken insulators to the replacement of danger signs chipped by stones or rifle fire. Each inspector reports by telephone to the central office at intervals of about two hours during the day. Reports of a serious nature receive immediate attention. Reports which are not considered urgent are mailed by the inspector at the close of each day's work.

A weekly round-table meeting attended by all inspectors serves to keep alive the interest of the men. Competition among them is keen. Charts are prepared which show a comparison of the breakdowns on the

TRANSMISSION-BREAKDOWN SUPERVISORS LOG SHEET

DATE

LINES AFFECTED	O.H. NOTIFIED	LINE SECTIONALIZED AT	BEGAN PATROLLING	TROUBLE LOCATED	LINE IN SERVICE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

CAUSE OF BREAKDOWN:-

COST OF INSP PER MILE..... NO. OF MEN USED .....
COST OF REPAIRS..... NO. OF TRUCKS USED.....
OUTAGE IN HOURS.....

SYMBOLS

S = Sectionalizing line or switching
@ = Will begin patrolling at
11 = Mobilize
TRC = To remain at present location and call in ( ) minutes
SO = System Operator
D = Dip in voltage
C = Telephone call-if it precedes name the director called man, if it follows name the man called
L = Location of trouble
R = Reported
W L = Will leave, if not followed by a time immediate departure is indicated

TIME

LOG SHEET FOR REPAIR FORCES SHOWS ORDERS AND MOVEMENTS

lines for which each inspector is responsible. Breakdowns which are due to the failure of the inspector to see or report hazardous conditions are emphasized by red circles on the chart. The result of a weekly discussion of this chart in open meeting has done much to reduce this kind of preventable failure to one or two per year.

Every effort is made to make the meetings interesting and of value. Each man is encouraged to talk, and in this way the inspection is being constantly improved as the experience of each man is shared by the others.

CLEARING TRANSMISSION LINE TROUBLE

Next in importance to keeping tie lines in operation comes the restoring of the lines to service, following breakdowns, in the shortest possible time. Experience has shown that the major portion of the time required to restore the line to service following a 66,000-volt failure is often taken up in locating the fault.

The network of improved highways intersecting the power ring is a great asset in reducing the length of outage. In attempting to improve our records for

A GASOLINE ENGINE WAS USED TO PULL WIRE

speed in the restoring of service it was early found that the dispatcher or director in charge could not prepare his plan of attack after the trouble occurred. To remove the necessity for hasty and often ill-advised decisions, maps were developed on which detailed directions concerning the points at which patrolling should start and the location of truck and material bases were designated by symbols. In preparing the maps careful study as to the best roads for access to various points on the line and the location of telephones was made.

Every section of the power ring is covered by such maps and the plan of attack is rigorously followed out. Immediately following notification to the overhead-lines division that a section of line is defective, the director of repair forces knows the exact points to which patrolmen must be dispatched (see arrows on map) and the most advantageous locations to which the repair trucks should be moved so as to be within striking distance of the trouble (see seals on map).

Since these maps have been used, the average outage following 66,000-volt line failures has been greatly reduced. Instructions to patrolmen are so simplified that there is little likelihood of a misunderstanding even by men not familiar with the particular line involved.

The director of repair forces maintains a log sheet on which his orders and the movements of the breakdown locations and repair forces are noted. (See page 907. From the time of failure to the time the line is repaired and returned to service each minute is accounted for. At some later time the log is subject to careful scrutiny to disclose any mistakes in dispatching or loss of time which could have been eliminated. The experience thus gained aids in reducing outages to a minimum. The cause of failure is summarized on the log, which is filed and becomes a permanent record of the breakdown.

Immediately following the dispatch of patrolmen on a faulty line, a number of repair trucks are equipped with emergency material and sent to the truck bases designated on the maps. A number of automobiles or light trucks which are used to distribute the patrolmen to needed points are held near telephones (see stars on map) and are available for transporting the patrolmen to the scene of trouble after it is located. The patrolmen then become repairmen.

Light, speedy trucks which ordinarily are used in light maintenance work or the testing of insulators are in almost hourly communication with the central office. These trucks have bodies designed especially for transmission maintenance and line repair. Following a breakdown, they usually have time to go to the nearest storeroom, load up with material and report at the truck bases before the trouble is located. Spotlights are operated from the storage batteries of the trucks, and portable, electric and carbide lamps are used by patrolmen and repairmen.

Breakdown material for use on lines remote from any storeroom is kept in concrete material houses built under towers at intervals on the line. These houses are about 6 ft. high and 6 ft. square and have steel doors. The contents of the houses are checked over each week by the patrolmen and an effort is made to replace any missing material immediately.

Breakdowns on the ring—i.e., physical damage to the line causing it to be out of service longer than the period required to reclose an oil circuit breaker—have been few. The causes of breakdowns, in the order of their destructiveness, have been lightning, trees or limbs of trees blown down by windstorms, and mechanical failure of insulators. Lightning is responsible for about 52 per cent of the failures, some of which were the result of direct strokes burning off the wires. The immediate cause of other failures was a power arc which followed a lightning spillover on a string of insulators.

Trees were formerly more of a menace than they now are. A systematic and persistent effort during the past two years to remove all trees which if they fell toward the line might cause trouble has brought results. During this period a solicitor has been constantly engaged in obtaining permission for the removal of trees. Experience has demonstrated that a tree-trimming crew consisting of a foreman and six men equipped with the necessary tools and a 2-ton truck can profitably spend all its time removing and trimming trees and clearing brush on the 66,000-volt ring.

The mechanical failure of insulators has been responsible for a few failures. Defective porcelain unable to stand the stresses caused by temperature changes apparently exists in only one lot of insulators. This cause of failure will be eliminated with the replacement of these insulators by others of tried and proved design made of better porcelain.

Limitations of Carrier-Current Telephony

Observations Based on Investigations on Duquesne Light Company's System—Duplex Operation Preferred—Spitting of Insulators, Charging of Arresters and Switching Troublesome

By C. A. BODDIE* and M. W. COOKE†

SUCH widespread interest has arisen among central-station men regarding the developments in "wired wireless" or "high-frequency" telephony as applied to high-voltage transmission lines that a brief analysis of this promising application of high-frequency currents from the viewpoint of central-station service seems desirable. In order to arrive at a fair conception of the value of a high-frequency circuit as compared with a physical telephone circuit which parallels a transmission line comparison of the advantages and disadvantages of each type of circuit will be of value.

A telephone circuit strung on the towers of a transmission line, in the absence of a better circuit, is very desirable, but is open to the grave objections that it is hazardous to use and is apt to be rendered inoperative by abnormal conditions in the power line, which is usually the time when it is needed most.

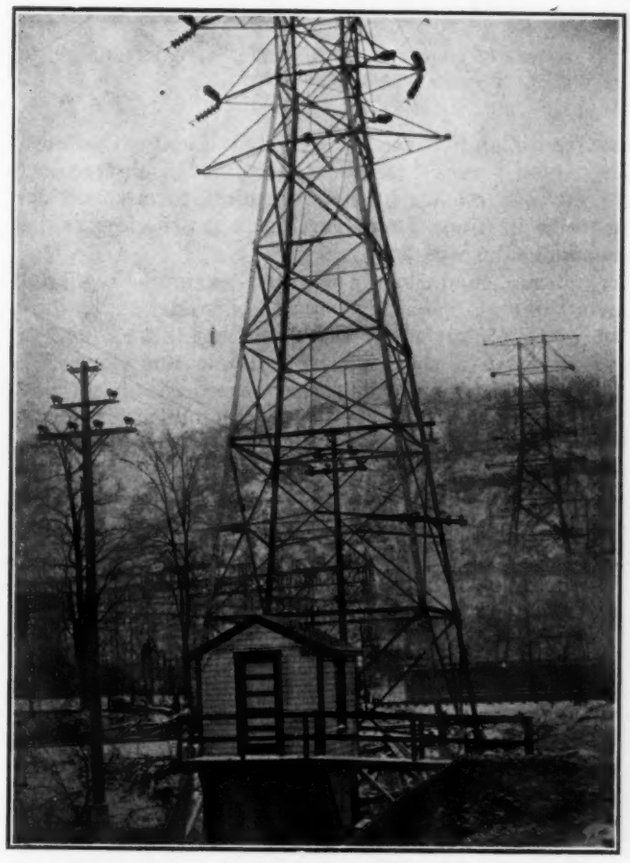
Under favorable operating conditions a fairly quiet telephone circuit is obtained over which clearly understood conversation may be carried on. However, this result is seldom obtained in practice because of the lack of attention to the details of protection, drainage and transpositions. The circuit can be used by line patrolmen from each tower in the line, the patrolman needing only an ordinary lineman's test set to establish communication with headquarters. The cost of construction is low.

Under abnormal operating conditions, on the other hand, the line will be so noisy as to be unusable. Surges in the power circuit will cause the protective devices in the telephone circuit to operate, and if some of these protective devices—particularly drainage coils—are installed outside of the stations, they cannot be switched out of the circuit and reserves switched in when the first set operates.

Failure of a power wire will frequently carry the telephone line down with it, and during high winds the lighter telephone wire may be whipped up into the power wire in the longer spans.

Where restrictions exist as to the ground clearance of the lowest wire on the towers, higher towers must be erected or poles set between the towers to support the telephone wires. It is not often practicable to set poles between the towers to raise the telephone wires, because the power wires may be so low that raising the telephone wires may bring them too close to the power line.

On the other hand, a separate telephone pole line built on the tower right-of-way is reasonably free of hazards so far as patrolmen and station operators are concerned. If the circuit consists of fairly large gage wire and is well insulated, carefully balanced and kept thoroughly trimmed out, it has all the advantages of a line on the towers. If provided with duplicate sets of arrester equipment at the terminals, it can usually be depended upon for service as soon as an abnormal condition in the power circuit is over.

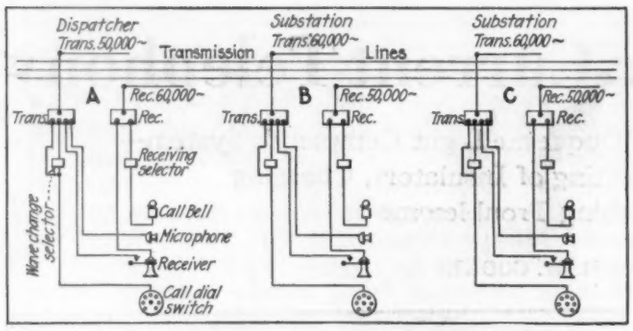


CARRIER-CURRENT EQUIPMENT WAS PLACED IN THE SHANTY BELOW THE LINE, AND WIRES WERE LED TO STATION

The disadvantages of this type of line are that its first cost and maintenance cost are high. The telephone pole line being already on the ground, it is almost invariably used to support 11,000 or 22,000-volt, three-phase lines when new customers must be served along the high-voltage lines. These lower-voltage lines are as a rule provided with single-phase transformer taps which usually cause unbalanced load in the power circuit and destroy the telephone-line balance. Besides, such construction introduces a hazard due to the possibility of the power wires coming down on the telephone circuit.

As compared with either of the foregoing types of physical telephone circuits, the carrier-current circuit can usually be provided at a fraction of the first cost. The maintenance expense will be considerably less than that of a physical circuit on separate poles and probably no greater than a circuit on the towers. Furthermore,

*Radio department, Westinghouse Electric & Manufacturing Company.
†Superintendent of telephones, Duquesne Light Company, Pittsburgh.



METHOD OF CONNECTING STATIONS FOR DUPLEX COMMUNICATION

greater reliability can be expected because the tower line which serves to guide the carrier high-frequency current will remain in service under storm conditions, owing to its rugged construction, when the less rugged telephone line will fail.

Abnormal conditions in the high-tension line will only make the high-frequency circuit noisy during the duration of the disturbance, and even the failure of one or two phases will not render communication impossible, so that at first glance the superimposed circuit seems to fill most of the requirements for communication service over a tower line. However, it seems to the authors that in view of the rapid development now taking place it would at present be advisable to install high-frequency communication apparatus only under favorable conditions.

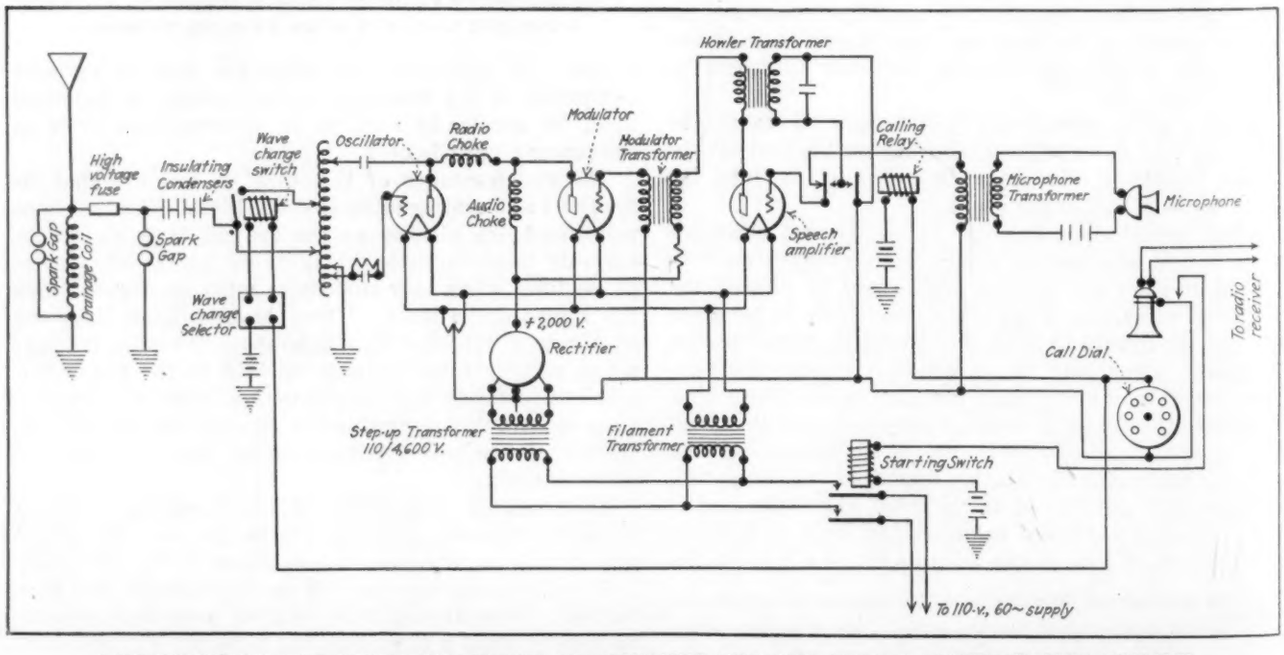
To bring out what the limiting conditions for carrier-current usage are, experiments have been made on the 66,000-volt lines of the Duquesne Light Company for the purpose of determining the feasibility of telephony and remote control of electrical apparatus by means of high-frequency currents superimposed on power lines. These experiments were conducted by the engineers of the Westinghouse Electric & Manufacturing Company, assisted by the communication department of the Duquesne Light Company.

Before the carrier-current experiments were conducted it was popular opinion that a transmission line affords a much more efficient medium for the propagation of high-frequency currents than direct space radio. This impression is probably due to the advertising nature of most of the current literature on the subject. There is also great confusion regarding the name to be applied to this method of communication. Such terms as carrier current, line radio, guided radio, wired wireless and even guided carrier current have been proposed and used. All of the above names are meaningless, and the authors propose to indentify the system by its one distinguishing characteristic, namely, "high frequency." We, therefore, will use the term "high-frequency telephony" in the following discussion to distinguish telephone systems using modulated high-frequency currents from the usual low-frequency telephone which operates on modulated direct current.

High-frequency currents may be introduced into the power line in two ways—either by means of antenna strung parallel to and usually above and below the power wires or by means of condenser-type bushings connected directly to the power wires. The experiments up to the present time indicate that most energy can be put into and taken out of the power line by using antennas.

From preliminary work which had been done on a 22,000-volt line, the Westinghouse engineers estimated that a 50-watt transmitting set would be powerful enough to transmit over the Duquesne Light Company's 66,000-volt line. It was found, however, that much more powerful transmitters were required, and the output was increased to 250 watts.

At the very outset of this work it was recognized that to be successful in load-dispatching service the system must be duplex. That is, it must be possible for a person to talk and listen at the same time as is the case with the usual wire-line telephone. A system which will not permit a person to talk and listen at the same time, but which only permits one person to talk while the party at the other end listens, and then requires both to operate throw-over switches, so that the one who was talking first can hear what the original listener says in reply, will rest under a serious handicap when



HIGH-FREQUENCY TELEPHONE TRANSMITTING AND SIGNALING APPARATUS USED BY DUQUESNE LIGHT COMPANY

compared with a duplex system which permits simultaneous listening and talking.

A further requirement is that the signaling shall be selective. Selective signaling means the ability to ring the bell of a particular station in the same way that the bell of a particular party is rung on a party-line telephone circuit. The necessity for this selective feature will be apparent when it is considered that between the two generating stations feeding into the Pittsburgh power ring there are eight large substations. Unless each one of these stations could be called selectively, the system would not be of practical use, since a signal sent into the line would call all stations when only one might be wanted, and the resulting confusion and delay might result in an improper switching operation being performed by one of the station operators.

The duplex and selective features have been successfully worked out.

One of the things which have been most annoying and for which no successful remedy has been found is the disturbance due to "spitting" insulators. It is generally recognized that an insulator may spit for years without apparently reducing its value as an insulator, and while as a matter of precaution continuous tests are carried on to locate and replace insulators which spit over, it is interesting to note that in large systems there is always more or less of this spitting going on. Conversations cannot be carried on successfully while this spitting is taking place. Furthermore, the spitting very often breaks up the trains of impulses used in selective signaling. This particular difficulty has been the most serious one encountered from the standpoint of talking continuity and reliability of signaling.

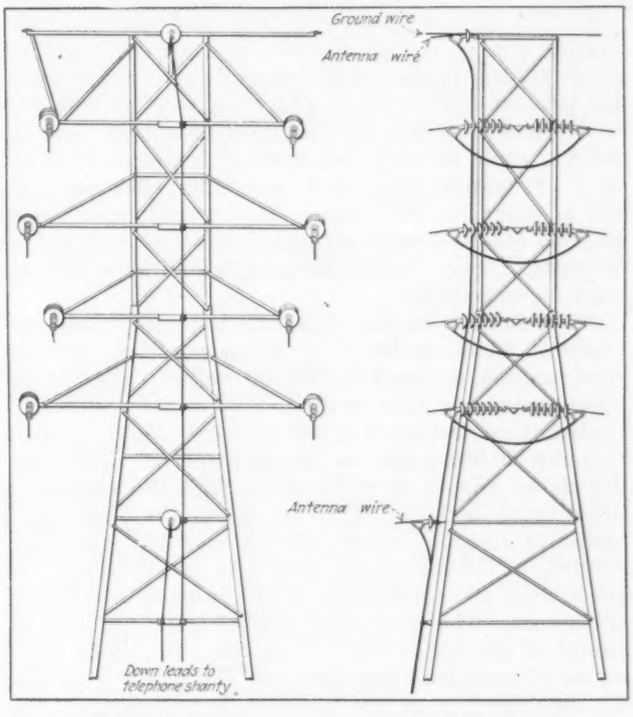
Disturbances introduced into the line through the charging of electrolytic lightning arresters also interfere in the same way that spitting insulators do. In a system in which there is a large number of arresters this is a matter of considerable importance.

CERTAIN WAVE LENGTHS BEST

In the installation between Brunot's Island and Colfax it was learned that the number of wave lengths which can be used satisfactorily is limited. During the progress of the experimental work frequencies ranging from 10,000 cycles to 500,000 cycles were explored with the idea of finding at which frequency the most energy was received at the other end. It was discovered that there are definite wave bands within which good transmission is possible. These bands range between 1,800-2,200, 4,500-7,000 and 14,000-23,000 m. With the apparatus set near the average values of these three bands—i.e., 2,000, 6,000 and 18,000 m.—good transmission is obtained. The surprising thing here is that at wave lengths outside of the bands mentioned virtually all of the energy sent out from one end of the line is absorbed before it arrives at the other end. It is assumed that the inductance and capacity values of the apparatus bridged across the power circuits at the intermediate substations are such that resonant circuits are formed which for all practical purposes are short circuits for those frequencies outside of the three bands named, or introduce impedances which seriously reduce the transmitted currents.

It is evident that owing to the complex system of reactances in a large power system a number of tests must be made to determine what frequencies will go through to a receiving station located at some point distant from the sending station. This is cited to indicate that the equipment cannot be installed with the same confidence that it will be ready to use when the installation is completed as one feels when ordering in an ordinary wire-line telephone.

The effect of switching operations in the tower-line circuits is greater than was anticipated, and it is not possible to predict with confidence the results which will follow the operation of any switch. The Duquesne Light Company tower line carries two 66,000-volt circuits, which until recently were usually in parallel at the two generating stations, but not in parallel at the intermediate substations. A striking illustration of the effect of switching occurred when during a conversation between the two high-frequency stations the amount of received energy at both ends suddenly



METHOD OF ATTACHING COUPLING WIRE TO TOWERS

dropped to about one-tenth of its previous value. In checking up with the system operator to see if any change had occurred in the transmission circuits at the time the change in amount of received energy had been observed, it was learned that the two power circuits had been paralleled at one of the intermediate substations. This substation was about 12 miles from the nearest high-frequency station.

Since the last observations were made, a system of relay protection for the power lines has been installed at each of the substations and generation stations, and the two circuits will ordinarily be paralleled at each of these stations in the future. From the results which were observed before the relays were installed it is to be expected that the high-frequency apparatus will no longer work on the original wave bands.

At most generating and substations it is difficult to string antenna wires on the power structures nearest the stations so that they can be led inside of the buildings, owing to the difficulty of getting them past the outdoor switching and protective apparatus. In practice this means the building of small houses out under the tower line, a span or two away from the main building.

This means that in order to be able to use the high-frequency set from within the station it must be extended by means of a wire-line circuit from the house in which the apparatus is placed to the telephone instrument in the station. A two-wire circuit has been perfected, using an ordinary dial-type automatic telephone, by the operation of which the high-frequency set is automatically started and the proper selective call sent out, substantially as is done in wire-line telephony.

NATURE OF SYSTEM USED

The nature of the communicating system as developed may be seen by a reference to the accompanying straight-line diagram, in which three stations are shown schematically. Each station is provided with two antenna wires, one for transmitting and one for receiving. This simple expedient of providing separate transmitting and receiving antennas is the most important single feature in the achievement of commercially stable and efficient duplex. By it a high capacitative reactance is interposed between the transmitting antenna and the delicate radio receiver, yet nothing is sacrificed in the way of transmitting and receiving efficiency. By the adoption of this means alone satisfactory duplex may be obtained with sets having a radio output of 50 watts or less. For higher powers additional features must be introduced.

As indicated in the diagram, the dispatcher may transmit 50,000 cycles in to the power line while his receiving set is tuned for 60,000 cycles. The various substations must then be set to receive the dispatcher's transmitting frequency of 50,000 cycles and they must transmit 60,000 cycles to the dispatcher. If the load dispatcher wishes to call station "B," the receiver is lifted from its hook. This act starts the dispatcher's transmitter, which sends out a steady high-frequency current of 50,000 cycles over the power line. The selectors at the substations do not respond to this kind of current. The dispatcher now dials the number assigned to substation "B." This operation sends out a series of modulated impulses over the power line; that is, the amplitude of the 50,000-cycle transmitting frequency is made to rise and fall at the rate of, say, 1,000 cycles per second. This modulated wave is rectified by the detector in the receiving sets in exactly the same manner in which the ordinary radio receiver functions. The output of the amplifier is fed into a second detector tube, in the plate circuit of which is a telegraph relay having a suitable high-resistance winding. The plate current of this tube is greatly reduced when a modultated signal is received. The relay closes its contacts each time a modulated impulse is received and hence repeats into the substation selector the impulses sent out by the dispatcher's dial switch. Each substation selector is a device which closes its contacts when it receives the proper number of impulses. Thus while all substation selectors advance during the dispatcher's dialing operation only station "B" selector closes its contacts. This closure picks up and locks in the bell relay. All selectors now return to zero. Station "B" call bell rings continuously until the operator lifts his receiver from its hook. This stops the bell and starts his transmitter, which now sends out 50,000 cycles, which is the frequency which the dispatcher is tuned to receive. Both parties may now talk and listen with the same freedom as in the case of the usual wire-line telephone. At the conclusion both parties hang up and the transmitters automatically shut off.

In the same way, any substation can call the dispatcher. This arrangement requires all communication to go through the dispatcher and does not permit communication between the substations since they are all tuned to transmit 60,000 cycles and all the receivers are set for 50,000 cycles. Hence no substation transmitter can communicate with another substation receiver. Communication between substations may be accomplished by throwing a wave-change switch in the calling substation, which automatically changes the substation transmitter and receiver frequencies to those normally assigned to the dispatcher. Suppose substation "C" wishes to call substation "B." After starting the transmitter by unhooking the receiver the substation operator dials 10. This sends out ten modulated impulses which are received only by the dispatcher's set, but does not ring his call bell because his call number is not 10. Hence nobody is disturbed. The dial switch is, however, directly connected to the wave-change selector which closes the transmitter-wave change switch and locks it in when ten impulses are received. This changes the antenna taps on the transmitter loading inductance and thereby changes the transmitter frequency to 50,000 cycles. Relays in the radio receiver transfer connections to duplicate primary and secondary tuned circuits adjusted to receive 60,000 cycles instead of the previous 50,000 cycles. The substation operator now dials the number assigned to station "B," which rings its call bell. Communication is now possible between "B" and "C," as was the case when "B" was called by the dispatcher. Thus the system as a whole is flexible in that any party on the system may freely communicate with any other party.

The oscillator and modulator tubes of the transmitter are of 250 watts capacity. The method of modulation is that now universally adopted in radio-telephone sets and known as the Heising or constant-current system. The principal feature of this system is the use of a large inductance coil frequently referred to as the audio choke, through which the oscillator modulator plates are supplied in parallel. Voice frequency is impressed on the modulator grid, which thereby varies the modulator plate current. This alternately robs and adds to the current flowing to the oscillator plate, which causes the amplitude of the high-frequency antenna current to rise and fall in accordance with voice frequency. A third tube of smaller capacity, known as a speech amplifier, is interposed between the microphone and the modulator grid, since the voice currents produced by the microphone have not sufficient energy to control directly the grid of a 250-watt tube. The speech-amplifier tube is also used to modulate the transmitter frequency during calls. The impulses from the dial switch act directly on the calling relay, which changes the grid connections of the speech amplifier so as to form a local oscillating circuit whose frequency is something lower than the transmitting frequency, which may be from 1,000 to 10,000 cycles as preferred.

The wave-change switch, as shown schematically, shifts the antenna tap on the antenna inductance coil, thereby changing the transmitter frequency. This is done through the wave-change selector, which acts only when it receives a series of ten consecutive impulses from the dial switch.

The 2,000-volt direct-current plate potential for the transmitter is supplied by a vacuum-tube type rectifier. The alternating-current pulses in the rectified current are completely damped out by a combination of con-

densers and inductances which are built in as part of the rectifier. A rectifier is to be preferred over a motor-generator set for this service because of the liability to failure of a 2,000-volt commutator and also because the 60-cycle alternating pulses in the rectifier are more easily elminated than commutator noises. The elimination of rectifier noises is permanent, whereas the commutator and brushes of a high-voltage direct-current generator require frequent attention.

The selectors used consist of a magnetically driven contact arm which moves over a series of contacts and a group of relays so arranged that unless the pause in the impulses from the dial switch occur on the right contact the arm automatically goes back to its initial position, without closing the bell circuit. This device is merely an adaptation of proved automatic telephone apparatus.

An illustration of what appears to be the proper attitude regarding this new communication development is said to have been taken by the Penn Central Light & Power Company, which is under the management of Day & Zimmermann, Inc. This company has a new power development in an inaccessible section of Pennsylvania. The problem of obtaining adequate communication service has had much study, with the result that the Bell Telephone Company was requested to advise what service should be provided and to quote rates therefor. The Bell company is said to have quoted a high construction cost and annual rental, due to the large amount of line which would have to be built through a rough country. As the private line would have been away from closely patrolled toll lines, its maintenance would have been difficult and repairs slow in case of failure, and the Bell company is said to have frankly advised against its construction and in favor of the installation of high-frequency equipment, for the reason that the high line would be more ruggedly constructed and would probably not fail under conditions which would probably cause the failure of the telephone line. As the result of this advice, the power company is reported to be planning to install five high-frequency sets, four in stations and one for portable use, with the intention of spending about $5,000 a year in the further development of the device.

Distribution in Export Trade

An All-Important Feature of the Foreign Policy of the Electrical Manufacturer Is the Organization Through Which His Sales Are Handled and Developed

By P. S. SMITH and W. L. URQUHART*

MANY manufacturers, inexperienced in selling to foreign lands, overlook entirely in considering the possibilities in export trade the fact that distribution is no less a factor in selling overseas than in domestic business. Once the decision is made that a certain product should be introduced to the distant market, there is no detail of preparation more vital than the determination of which will be the best method of distributing the goods to the purchasers. For the very fact that the market is far away and that the goods must be transported into countries and under conditions with which the manufacturer has little familiarity and over which he can have no control makes it all the more important that effective machinery be set up not only to carry forward the shipments themselves but to insure adequate representation for the manufacturer and provide a contact with the foreign buyer, attenuated though it may be.

SIX PLANTS FOR EXPORTING

No manufacturer should fail to fix upon a foreign selling policy. This policy should aim to cover a period of, say, ten years, during which time it will be creating permanent relations which will continue to yield a profitable trade indefinitely in the future. To do this requires some initial expense and much analytical investigation. The results will be a determination of the markets where one's goods cannot be sold and a knowledge of and connection with those where profits are to be had with proper developmental and follow-up procedure.

The problem is different for each manufacturer as its correct solution rests upon many variables. These include particularly the type of goods involved—whether they are standard, enjoying large demand, or special, with restricted application; whether purely a merchandising or an engineering proposition, and whether there is great competition or not.

The best solution to these problems in a given case can be approximated, if not actually attained, by the selection of the right ways and means at the disposal of manufacturers to enter foreign markets. Different selections will be made for different problems, but they all will be based upon the several methods brought out in this article. For there are in fact six distinct plans under which a distribution system may be set up for export selling.

1. Manufacturers' Branch Offices.—A few manufacturers will be able to establish their own branches abroad. This usually can be done only in the case of a very large company controlling a complete line of apparatus and small materials so that the volume of combined sales will be large. If managed on correct merchandising principles, this method offers the advantage of controlling a large share of the market directly from the factory. Stocks will be carried locally to supply deficiencies in the shelves of customers while they are waiting for regular orders to come forward from the factory. Some of the tendencies to be guarded against are the erection of a local selling organization with too high an overhead for the volume of sales, the desire of the customer to depend largely upon the company stocks instead of upon his own invested capital, and the selling of goods to the retail or other small dealers who are the legitimate customers of the wholesaler and jobber.

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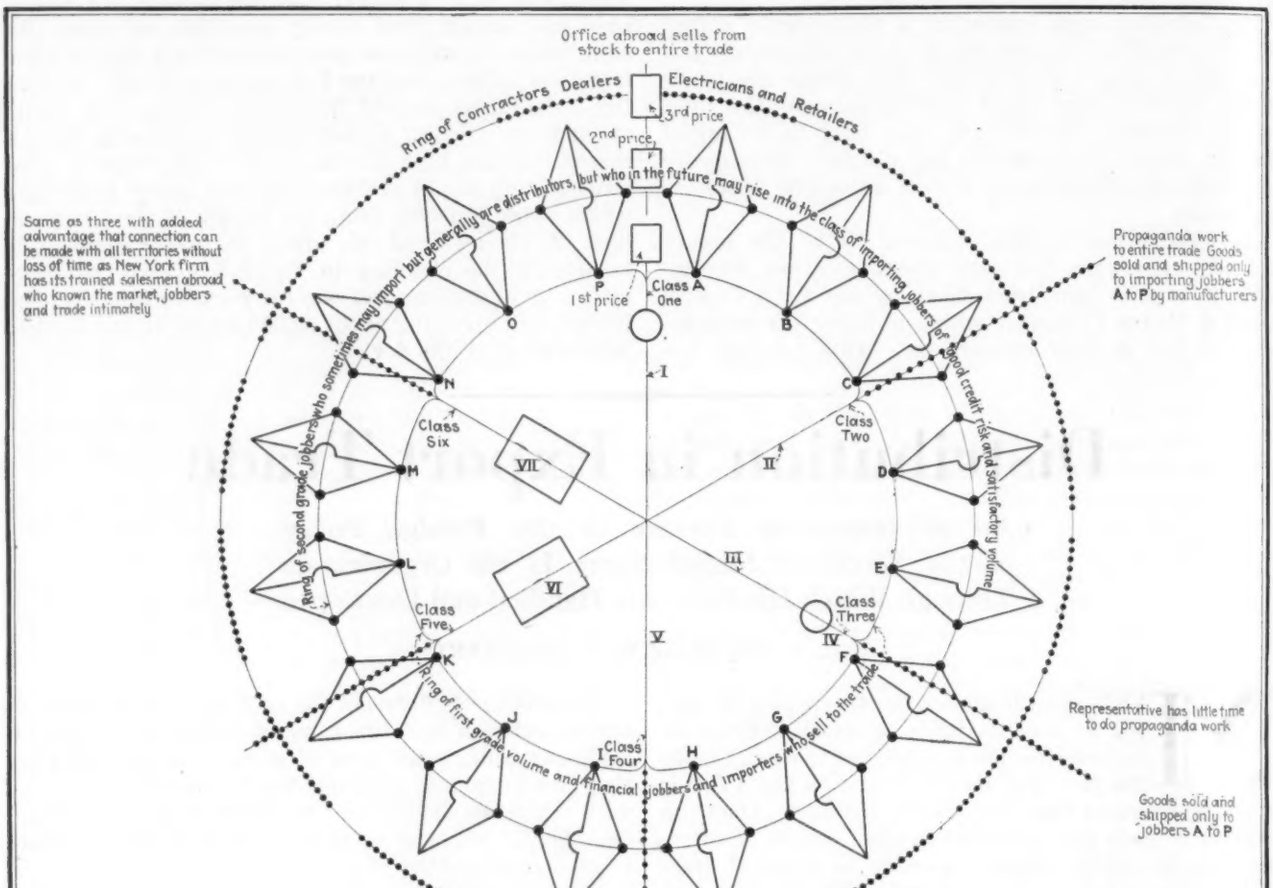
Only if very strong can one afford to ignore the prerogatives of the latter houses.

2. Own Salesmen Abroad.—Where it is not possible or desirable to establish a branch office abroad a very satisfactory method may be to maintain one's own salesman in the center of large business possibilities. He would work on a salary or salary and commission basis and solicit orders from the trade to be shipped direct

3. Foreign Group Salesmen.—General manufacturers' representatives, working on commission, handling various lines and soliciting orders to be shipped directly to the jobber, take the place of employee representation very efficiently at times. They are much less expensive than the resident salesman by reason of their expense being divided over a larger number of lines, hence not necessitating so large a commission. Care must be


Office abroad sells from stock to entire trade
Ring of Contractors Dealers
Electricians and Retailers
3rd price
2nd price
1st price
Same as three with added advantage that connection can be made with all territories without loss of time as New York firm has its trained salesmen abroad who known the market, jobbers and trade intimately
Propaganda work to entire trade Goods sold and shipped only to importing jobbers A to P by manufacturers
Class A One
Class Two
Class Three
Class Four
Class Five
Class Six
Ring of second grade jobbers who sometimes may import but generally are distributors, but who in the future may rise into the class of importing jobbers of good credit risk and satisfactory volume
Ring of first grade volume and financial jobbers and importers who sell to the trade
Representative has little time to do propaganda work
Goods sold and shipped only to jobbers A to P
Restricts volume to the trade which one single importing jobber can control or supply
I Manufacturers own stock abroad
II Factory salesmen abroad solicits orders from importing jobbers A to P
III Manufacturers representatives abroad
IV Represents several non-competing manufacturers' goods
V Exclusive purchasing rights to one jobber or his New York office or purchasing agents
VI Exclusive selling rights New York Exporter Pays cash but sells to trade at a profit thus increasing cost to trade
VII New York manufacturers representatives

A GRAPHIC PICTURE OF FOREIGN DISTRIBUTION AND THE SIX PLANS WHICH AMERICAN MANUFACTURERS MAY FOLLOW IN SELLING ELECTRICAL PRODUCTS TO THE EXPORT MARKET. RADII "CLASS 1-6" INDICATE METHODS OF APPROACH

from the factory. He might work the field alone or be connected, at factory expense, with the office of the local exclusive agent. This is done particularly for handling machinery and technical lines requiring an expert to do justice to them. This method is expensive also and can be used only where there are prospects of large sales at a fairly high margin of profit. Under these conditions this is, perhaps, the best of all the systems, as the salesman is an active influence in maintaining the jobber's stocks; and, because he is trained in the line he sells, he can, if he has the incentive of being paid by the results he shows, greatly influence the retailer and even the customer to specify his principal's goods.

taken, however, to see that such a representative has not taken on too many lines to do justice to each. This and other measures are not always feasible, as the representative is independent of any single manufacturer and apt to be hard to control.

4. Exclusive Right to Foreigner.—Exclusive purchasing rights may be given to one selected jobber abroad, provided he is willing to guarantee a minimum annual amount of purchases. When this is done the outlet for at least that quantity of goods is assured, but this is very seldom a satisfactory basis. If the goods are new or unknown, the sales that any one can guarantee are not going to be attractive to a manufacturer thinking in terms of domestic sales. Even under the most favor-

able conditions, the jobber must be conservative in his guarantee for his own protection. A note of warning should be sounded, too, that the exporter may assure himself always that the jobber has not taken on the line merely to withhold competition with some other line in that territory.

5. Exclusive Export Agent.—In other cases the manufacturer grants exclusive rights to some organization such as the general export merchant, the commission house or the buying branch for a foreign house, all located in New York.

It will be understood that the difference between the export merchant and the commission house is that the export merchant buys in the open market for his own account and sells at a profit by increasing the invoice value, whereas the New York commission house, properly speaking, receives a commission from the importer abroad for purchasing material required.

The two principal defects with this plan are, first, that the manufacturer has no control over his ultimate market and so does not know who his customers really are nor whether he is getting his full share of the business, and, second, that these commercial units are very seldom in position to do any real constructive selling or propaganda. Their chief function is to buy upon receipt of an order from a foreign client, usually without stipulation as to maker. When they accept agencies it is also well to be assured that they have the proper personnel to handle a line of electrical goods and to push it actively on behalf of the manufacturer. The greatest advantage from dealing with them is that they generally pay cash in New York, thus eliminating from the transaction all question of credit or collection.

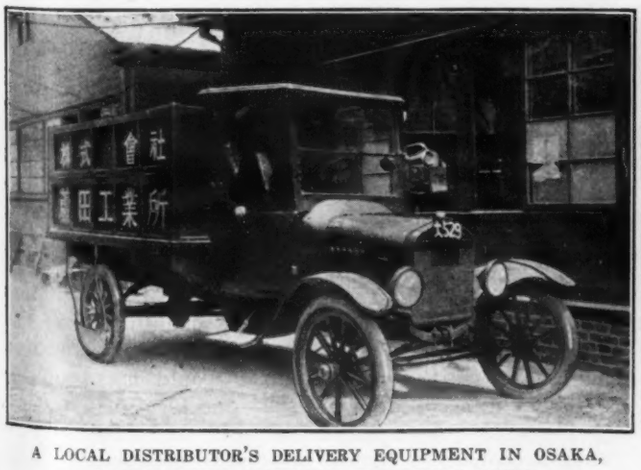
6. Manufacturers' Export Group.—There has been reserved until last the method which seems to have the best chances for success, especially for a group of manufacturers of wiring devices and other allied material. This method, which may be called the combination export department, consists of the exclusive rights given by manufacturers to a New York manufacturers' representative having jobbers or salesmen abroad soliciting trade from the wholesale importer-dealers. Just why this offers an exceptional opportunity—that is, the maximum of profit—for those to whom the direct personal representative in the field is not feasible will be shown.

Each manufacturer in considering these possible plans for distribution can decide for himself by the process of elimination just which ones are not applicable to him.

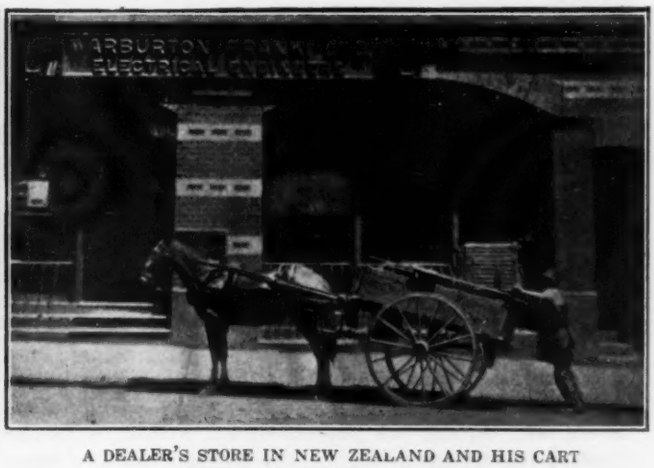
Distribution methods in foreign trade are not necessarily alike for different foreign markets, but in every case it should be the endeavor of the manufacturer to bring them as closely under his control as possible. This may be illustrated by citing the case of the several countries of the Orient which together now absorb approximately 20 per cent of our electrical exports. The general practice in past years seems to have been to sell almost exclusively through middlemen as indicated by method No. 4 instead of building up direct contacts. As a consequence, few manufacturers know the exact way in which their business is being or should be developed within those countries. Method No. 6 then might be the ideal arrangement under these circumstances.

But what is desired by the individual manufacturer

A SIDELIGHT ON DISTRIBUTION IN MEXICO—DRAGGING A TRANSFORMER THROUGH THE MOUNTAINS



A LOCAL DISTRIBUTOR'S DELIVERY EQUIPMENT IN OSAKA, LOADED WITH AMERICAN ELECTRICAL GOODS



A DEALER'S STORE IN NEW ZEALAND AND HIS CART CARRYING AMERICAN METERS

perhaps more than anything else is the employment of men who know the specific requirements in each different country as it applies to his own line. Obviously there are a number of men in the electrical industry who have specific knowledge of this kind, and for this reason plan No. 6 will appeal as being the most attractive of all the other methods to the average manufacturer, and especially to the manufacturer who has not yet built up a large export organization.

ELECTRICAL EXPORT LINES

There are approximately fifteen hundred manufacturers in the United States producing electrical material, to most of whom this article on distribution applies. The main groupings are as follows:

Motor appliances.
Heating appliances.
Fans.
Interior-wiring devices.
Wire.
Small motors and motors up to 10 hp.
Insulated materials and devices, including tapes, etc.
Lamps.
Batteries, dry and wet.
Conduit and conduit fittings.
Pole-line material.
Motors.
Instruments.
Lighting fixtures and glassware.
Wireless supplies.
Bells and annunciators.
Radio-telephone sets and parts.
Special material.

Many, if not the majority, of these fifteen hundred manufacturers do sell to some extent for direct shipment abroad, but most of them have no definite knowledge as to the standing of the importer in the foreign territory, of his trade standing, of the way he distributes or the possibilities for extending his business by careful sales work.

METHODS DIFFER WITH COUNTRY

Sales methods, in spite of claims to the contrary, do vary considerably, depending upon the country. For instance, in the Argentine all the materials in these classifications could be sold direct to some fifteen or twenty merchants who are thoroughly dependable as regards credit and sales organization. However, there might be only five firms in Belgium, New Zealand or India; three in Egypt, or in the case of territories such as China and the Dutch East Indies, Norway or Italy, satisfactory direct distribution could be obtained only through one single firm. A question now arises immediately in the minds of the majority of these fifteen hundred manufacturers as to how they can learn the names and obtain the co-operation of these chosen firms through the world.

The answer should be and is a simple one, for it consists in the carrying out of the basic principles as outlined in the combination export department method. It is to be remembered, first of all, that all the materials in the column above are, properly speaking, jobbers' supplies, and it is obvious that the importing jobber who distributes to the smaller jobber, to the inland small-town contractors, dealers and hardware shops is the one to be looked to. And it is these importing jobbers in whose hands lies the future of the foreign sales of electrical material.

Returning now to the combination export department method already outlined as Method No. 6, manufacturers who do not yet possess direct contact with the class of importing jobber in the foreign country must obtain that contract if their sales are going to be a prominent and dependable factor. The object in mind should therefore be to build up an organization in each country, sometimes having that organization possess sub-agencies, as in the case perhaps of France, Chile and India, where there are more than one importing and distributing center.

As already mentioned, the entire electrical line which could be sold to jobbers can be classified under not more than twenty main sections, so that it would be easily feasible for twenty manufacturers to group together and form a centralized export department which would be composed of men thoroughly confident of the possibilities of export trade in the first place, and, secondly, well versed in the requirements of the majority, if not all, of the countries where market waits, and, thirdly, knowing by name and frequently from personal visits to foreign countries the character, caliber and trade standing of the main importing jobbers in each country. This centralized export department would most profitably be handled on a commission and fixed-contribution basis, receiving its remuneration by a commission on the sales made after they were fully paid for by the client, with a stipulated monthly allowance by each manufacturer paid for maintenance, through the first year at least, while the developmental work was being carried out.

ORGANIZATION OF GROUP

The organization would employ trained electrical salesmen as manufacturers' representatives abroad, who would solicit business and take orders from the first-class importing jobbers and send these orders to the group export department in New York, which would distribute them to the various manufacturers concerned. The manufacturers would support the export department by supplying literature, sales information and manufacturing information, all of which would be passed on by the group export department to every country in the world where such manufacturers' products could be sold. The group export department would therefore be a true export sales department by informing customers throughout the world of salable material produced by each manufacturer it represented and referring the client to the resident salesmen for up-to-date information, terms of sales and delivery dates.

One of the main features of this organization would be that each manufacturer would retain his individuality as regards his product and the use by the export organization of the letterhead of the manufacturer whose products were being pushed in each foreign country; also, the control of the manufacturer's products would always remain in the manufacturer's hands. Drafts would be made out in his name, forwarded for collection and sent back to the manufacturer direct in his name. At all times the manufacturer could refuse to accept any specific order from any certain customer should he consider that the credit information supplied by the export department would not warrant the acceptance of such an order.

HOW GROUP AGENCY FUNCTIONS

Regarding the matter of financing, in the event that the credit information sent to the manufacturer was sufficient to obtain approval of the acceptance of a specific order, the manufacturer would make up the shipment in accordance with the specifications supplied by the export department and ship the goods to New York accompanied by the necessary documents—draft

on customer, export declaration, invoice and a bill of lading—and the export department would then take these documents and attach thereto the other necessary papers, such as ocean bill of lading and insurance certificate and would, in fact, attend to the dispatch of the shipment and add to the draft the expenses incurred for freight, insurance, cartage and so forth in accordance with the manufacturer's own terms of sale. The export department would in turn obtain reimbursement for the exact cost of clearing the shipment from New York, present the draft and attached documents to the bank for collection in the name of the manufacturer, and the bank would obtain payment from the customer and remit direct to the manufacturer.

Other points in favor of the group export department are the facts that, except in the preliminary or analytical stage, the cost of maintenance would be fixed by a commission depending solely upon the volume of foreign sales made; the information regarding clients would be complete; the information regarding possibilities of sale in each country would be complete as that organization's resident abroad would depend for his livelihood upon the group export department; instructions given by the department would be much more carefully attended to and carried out; each manufacturer would maintain his individuality from beginning to end of every transaction; skilled salesmen could be employed abroad who are fundamentally electrical men and who would not have to spend part of their time in visiting hardware importers and selling sanitary goods, foodstuffs and other imports as so many so-called manufacturer's representatives abroad do. By reason of the salesman in the foreign country representing as many as twenty different manufacturers, there would be sufficient income from the commissions to make it worth his while to do a thorough job not only by selling to the importing jobber but by helping that jobber sell the products, through bringing the new devices for which America is rightly famous to the attention of the local architects, builders, contractors and so forth.

Hartford's Combination Residence Rate

How It Was Introduced for Trial Period and Why—Four Objectives Sought—Results of a Year's Operation—Fewer Than Two-tenths of 1 per Cent of Residence Customers Desired Return of Old Rate

EXCLUDING cooking and refrigeration, the requirements of household appliance service are estimated at Hartford, Conn., as potentially from 30 kw.-hr. to 40 kw.-hr. per month per residence, with perhaps 20 kw.-hr. additional for lighting. The latter is low compared with the lavish use of illumination that customers would like to make under a more favorable rate than 10 cents per kilowatt-hour. Under the ordinary lighting rate this business simply does not come, and the resistance to the free use of appliances resulting from this straight meter rate is a stiff obstacle to the domestic utilization of electricity. In Hartford, as elsewhere, inducements were offered in the way of special rates to get appliances used. Failure resulted. Customers having power circuits got a 3-cent or a 4-cent rate and used the service liberally, but these were a mere bagatelle compared to the total number of customers. After fifteen years' effort a grand total of 500 out of 35,000 customers in Hartford had been persuaded to install special wiring. The proportion was too small to be justified.

APPLIANCES "UNSOLD" ON LIGHTING RATE

From the Hartford company's standpoint, an appliance sold to operate on a lighting rate is not a "sold" appliance, at least for the rank and file of the customers. In order really to "sell" a flatiron, as Vice-President Samuel Ferguson put it before the New England Division, N. E. L. A., at a recent meeting in Worcester, the salesman must sell about $50 worth of wiring to insure its full use on a power circuit. In Hartford this means that a million and a half dollars' worth of wiring would have to be sold to customers before the full use of residential appliances could be insured. Such a task was seen to be too large a handicap, and the way out was via the two-part rate, the working out of which required an exhaustive study of all available rates of a residential character.

The rate in effect prior to the inauguration of the combination rate was a straight-line meter rate of 10 cents per kilowatt-hour. The new rate reduced the energy costs to the consumer, but included a flat charge of 5 cents per month for each 100 sq.ft. of floor area, outside measurements. In computing floor area the outside dimensions of the building multiplied by the number of floors were taken, less an allowance for walls, etc., of 4 per cent per 1,000 sq.ft. of over-all area up to 10,000 sq.ft., with a minimum allowance of 10 per cent. Bay windows, unfinished attics, cellars and porches, as well as incidental barns, garages and other outlying buildings unfitted for living quarters, were not included in the computations of floor area. A uniform energy rate of 6 cents per kilowatt-hour by meter is charged for all electricity used.

The new rate went into effect in January, 1922. Ten days before the new rate was announced to the public the directors of the company passed a rate which was published in the local press without announcing the details. The vote in substance said that the management was to file a new rate which would do the following four things:

1. Cause a reduction of approximately $100,000 in the yearly total of residential bills as a class; i.e., reduce the revenues from residential service approximately 10 per cent.

2. Distribute that reduction in proportion to the use made of the facilities required to furnish the service. This meant that a man with a bad load factor would get no reduction, while one with a good load factor would get the full benefit. The "facilities required to furnish the service" did not mean the meter. The company maintained that the meter charge is included in the energy component, but that its fixed charge is the interest and so forth on the station and lines to serve the house.

3. Make the distribution of reduction to residence

consumers without distinction between large and small customers; i.e., a small customer with a good load factor should get a reduction, a large customer with a bad load factor should not. No advantage was planned for the large customer because he was a large customer.

4. Provide a means whereby an average customer could obtain 30 per cent more electricity at an increased bill not to exceed 10 per cent.

The new rate was announced in December, 1921, in a display advertisement (Fig. 1). Here all the facts were laid upon the table and the various steps by which other rate schemes had been eliminated were set forth and the consumers shown exactly what the new rate meant to them. Most important of all, the consumer was shown that for relatively large uses of energy he would receive a material reduction in cost, but that for abnormally small use, either in individual months or continuously, the rate would be higher than the old one. The fact that the consumer has it in his power to "make his own rate" was stressed and illustrated by an example.

The new rate was not a service charge, but was an area charge, the area being a measure of the demand. One objection to a service charge was taken away by the fact that for a small customer it was based on a small house, for a large customer on a large house. The new 6-cent energy rate in place of 10 cents appealed to the public from the outset. For an ordinary lighting customer the area charge combined with the energy used for lighting made the company whole on a 9-cent lighting rate; that is, gave the same income as a 9-cent rate. Beyond an average use of lighting, the rate was 6 cents. This put a power rate into every room of the homes of 35,000 customers. The lighting bill was taken care of by the sum of the area charge plus the energy at 6 cents, and the additional use for appliances or extra light was taken care of by the 6-cent energy charge.

Announcements were also made that the company purposed to try the new rate for a year, but if at the end of that time it should for any reason prove unpopular and the customers desired a change, a return

M. H. L. 120A

AGREEMENT FOR REFUND

No. 4200

M..... Address .....

having purchased during 1922 an electric ..... on our Order No. .....
for use at his home, we hereby agree that, after December 31st, 1922, up to the amount paid to us for the above stated appliance, we will repay to the above customer the amount by which his payments for electric current used at his home during 1922, on our prevailing residence meter schedules, exceed the amount which would have been paid to us for such current on the 1921 residence meter schedules.

Application for such repayment may be made after December 31, 1922, by presentation of this certificate or by person or letter with statement of article purchased and approximate date.

THE HARTFORD ELECTRIC LIGHT COMPANY

1921 Residential Light 10¢ K. W. Hr.
1922— " " Area charge plus 6¢ K. W. Hr.

By .....

FIG. 2—COUPON FOR REFUND ON APPLIANCE IN CASE LIGHT BILL INCREASED

OUR RATE REVISION

Our Revised Residential Lighting Rate, Effective January 1, 1922, is Announced as Follows

Combination Flat Rate and Meter

(1) FLAT RATE, 5 cents per month for each 100 square feet of floor area, outside measurements, with due allowance for walls, closets, etc.,
plus (2) 6 cents for each unit of electricity used by meter. Lamp renewals as at present.

THE FOLLOWING LETTER IS REPRINTED FROM TUESDAY'S "COURANT"

THE HARTFORD ELECTRIC LIGHT CO.
HARTFORD, CONN.

Dec. 20, 1921.

To the Hartford Courant,
Hartford, Connecticut.

Gentlemen:-

In to-day's issue of your paper is contained the announcement of our new combination rate for electric current for domestic use, superseding the existing 10¢ rate.

This rate is designed to make possible a more liberal use of our service, and to change used which are now luxuries, on account of the 10¢ rate, into inexpensive necessities at a 6¢ rate

The change involves a decrease in our revenue of approximately $100,000, and it is only our confidence that the new rate will correspondingly stimulate our sales, that justifies this reduction, as prices of fuel and labor have not yet fallen sufficiently to materially affect our costs.

The new rate is fair to all, and will reduce the bills of all customers in the months where an average use or more is made of the facilities which we furnish. There will, of course, be an increase of rate in any case or in any month where the use made of our facilities is abnormally low, as in some cases would occur in the summer.

While we believe that the new rate is fair, logical and for the best interest of all, we realize that it is new in Hartford, and if for that reason it proves to be unpopular, it is valueless, as "good will" is our most valuable asset. We, therefore, make the following specific agreement, namely:-

"If after one year's fair trial of this Combination Rate, it should for any reason prove unpopular, and our customers desire us to change, we will return, either to the present 10¢ rate, or if conditions warrant, to such lower rate than 10¢ as our books at that time justify."

We do not believe such change will be desired, but wish to assure our customers that in the future as in the past, we will endeavor to conduct our business as far as possible in conformity with their wishes.

Yours very truly,

THE HARTFORD ELECTRIC LIGHT COMPANY.

S. Bingham Vice-President.

The above rate is in accordance with the vote of our Directors passed November 22, 1921, which stated that the revision must do all of the following things:

(1) Cause a reduction of approximately $100,000 in the total of house lighting bills as a class, based on the last 12 months' use.
(2) Distribute that reduction in proportion to the use made of the facilities required to furnish service.
(3) Make that distribution to residence customers without distinction between large and small customers.
(4) Provide a means whereby an average customer may obtain 30% more current at an increased cost of not more than 10% above his present bills.

Other Rates Which Were Considered and Rejected

9 CENTS FOR EACH KILOWATT HOUR

This is a reduction of 1 cent per kilowatt hour from the present 10 cent rate. This meets point 1, but does not cover 2, 3 or 4, as this type of rate does not take any consideration of the use of the facilities required to furnish service; it is not low enough to meet point 4.

CUSTOMER CHARGE OF 50 CENTS, PLUS

7 cents for each unit of electricity. This meets point 1, but fails on points 2 and 3, as it is not based on the use of facilities required to furnish service; it is not low enough to meet point 4; also we do not believe a flat charge per customer, regardless of size, to be as fair.

BLOCK METER RATE

10 cents for first 15 kilowatt hours; 7 cents for excess. This meets point 1, but fails on points 2 and 3 as it is not based on the proportionate use made of the facilities required to furnish service; it is not low enough to meet point 4.

A

For the interest of those of our customers who wish to know why this rate was selected, we print herewith several rates used elsewhere which we have been figuring on. All of these would make the initial reductions desired in point (1) above, but each of them fails in most one or more of the other requirements, or has some undesirable feature.

THE RATE WE HAVE SELECTED AS ANNOUNCED ABOVE IS A COMBINATION OF THE POPULAR HARTFORD FLAT-RATE, SLIGHTLY MODIFIED, WITH A LOWER METER RATE THAN WE HAVE EVER HAD.

Other Rates Which Were Considered and Rejected

COMBINATION FLAT RATE BASED ON SOCKETS AND METER

Flat rate of 3.5 cents per socket, plus 6 cents for each kilowatt hour. This meets all the points, but causes annoyance to the customers on account of the frequent inspection trips to count the sockets, it is impractical with 40,000 customers.

COMBINATION FLAT RATE BASED ON ROOMS AND METER

Flat rate of 20 cents for each room, plus 6 cents for each kilowatt hour. This meets all the points, but causes annoyance due to the necessity of our men going frequently through all the house: It is also somewhat unfair in charging the same for a small room as for a large room.

B

COMBINATION CUSTOMER CHARGE, FLAT RATE AND METER

A customer charge of 50 cents, plus a flat rate of 4 cents for each 100 square feet, plus 5 cents for each kilowatt hour. This meets all the points. It is in use elsewhere in Connecticut. It results in a lower energy rate than the one we have adopted. But we have been led to believe that our customers did not care for a uniform customer charge, and so have eliminated that element from our new rate.

C

Effect of the New Rate

The effect of the rate on each customer depends upon his use of the facilities required to furnish service. If his use, for the size of his house, is larger than average then his reduction will be correspondingly greater. If his use, for the size of his house, is less than average, then his reduction will be correspondingly less. In a small number of cases, or in some months, if the use, for the size of the house, is abnormally small, then the rate will increase. In this way each customer makes his rate by his use.

The way the rate works out in the case of the average customer is shown in the example printed herewith.

THE AVERAGE CUSTOMER

The present average customer uses 23 units a month, amounting on the old rate to... $2.30

On the new rate, his bill would be:

(1) Flat rate, average area 1,400 square feet at 5 cents a hundred	$ .70	
(2) 23 units at 6 cents	1.38	2.08
Saving		.22

He can take this saving, or if he wishes he can use electricity more freely at lower cost. Assume that he uses 30% more, then his bill would be:

(1) Flat rate as above	$ .70	
(2) 30 units at 6 cents	1.80	$2.50

Note that if he had used this increased amount on the old rate, it would have cost $3.00, instead of $2.50.

The Low 6-Cent Rate Makes Possible, for Large and Small Customers the Liberal Use of Our Service, for Better Lighting and for the Many Electric Labor-Saving Devices. The Cost of Operating Any Lamp or Appliance is Reduced 40%, or Nearly One-Half.

Increased Use of Our Service Will Make Possible Future Decreases in Rate Which Will Be Made as Soon as the Sales of Electricity Grow Sufficiently to Permit.

The Hartford Electric Light Company

266 PEARL STREET CHARTER 3330

FIG. 1—FULL-PAGE ADVERTISEMENT ANNOUNCING NEW TWO-PART RATE IN HARTFORD AND SHOWING DETAILS OF RATE AND HOW IT AFFECTS DIFFERENT CUSTOMERS

THE HARTFORD ELECTRIC LIGHT CO.
266 PEARL STREET
HARTFORD, CONN.

ADDRESS YOUR REPLY TO THE COMPANY

IN YOUR REPLY REFER TO

January 10, 1923.

To Our Residence Lighting Customers:

A year ago we revised our residence rate from the previous 10¢ rate to a 6¢ energy rate plus a fixed charge based on area of customer's residence, a method of charge which was entirely new to most of our customers. From results elsewhere we were sure that it would prove advantageous to this community. We estimated that it would mean a reduction of approximately $100,000 from the old rate, and at the same time more electricity for less money. We asked our customers to give the new method a fair trial for one year. We also agreed that if after a year's trial the new method should prove unpopular we would abandon it.

The trial year has now passed and we thank you all for the fair tryout you have given the rate. We believe that the majority of you are pleased with the results because of the following facts, among others:

1. There are now only about one-quarter as many complaints on bills as there were with the old rate.
2. The public has paid $94,724 less for the total of its household electric bills in 1922 than it would have paid if billed under the old rate.
3. The reduction in cost of current at 6¢, as compared with 10¢, makes possible the use of labor-saving appliances in the home to an extent not otherwise possible or economical.

It is possible, however, that we have misjudged public sentiment. Therefore, as promised, we are giving our customers an opportunity to register their disapproval by the use of the attached coupon, which the Mayor has kindly permitted us to address to his office, in order that the count of same may be made by a third party.

Yours very truly,

THE HARTFORD ELECTRIC LIGHT COMPANY,
S. Ferguson
Vice-President

Instructions on Filling Out Coupon

1. Coupon must be signed by the customer. See that the signature is the same as the name appearing on the face of your last bill.
2. Fill out the blank space on the coupon with the cost per day as obtained by dividing the area charge appearing on your bill by 30 days. This requirement is essential for two reasons:
   a. That you may surely know how small an amount you are paying in return for the benefit of a rate reduction from 10c. to 6c.
   b. That the genuineness of the signature may be checked, as this information is known only to the customer and to the Company.
3. Any other reasons, comments or criticisms which you think should be brought to the Company's attention may be written on a blank piece of paper and attached to the coupon. Constructive suggestions are always welcome.
4. After filling out and signing the coupon, same should be mailed to the Mayor not later than January 13, 1923.

Hon. Richard J. Kinsella,
Mayor of Hartford,
Municipal Building,
Hartford, Conn.

Dear Sir—

In order to obtain the reduced price of 6c. for electric current instead of the old 10c. price, I have to pay the Electric Light Company a flat charge of .... cents per DAY, and I understand that all others are billed a similar charge, varying in amount in accordance with the size of the house.

Because of my relatively small use of current in proportion to the size of my house, this flat rate overbalances the reduction in the cost of the current. My family and I do not see the need of enough additional electricity in our home for labor-saving appliances or for lighting at the 6c. price to make the new rate advantageous to me. Please record me as preferring the 10c. rate.

Yours truly,

.....
Name of customer

.....
Address

(For other reasons or comments use an attached sheet.)

FIG. 3—ADVERTISEMENT OF METHOD AND COUPON FOR REQUESTING FORMER RATE

RICHARD J. KINSELLA, MAYOR
ABRAHAM S. BORDEN, SECRETARY

City of Hartford.
CONNECTICUT.
OFFICE OF THE MAYOR.

January 15, 1923.

The Hartford Electric Light Company,
Hartford, Conn.

Gentlemen:—

With reference to your advertisements which have appeared in the local newspapers January 10th to 12th, inclusive, regarding your 6 cent residence lighting rate, this office has received a total of 67 coupons expressing preference for the old form of rate. We understand from certificate of Messrs. Brash & Blanchard, Certified Public Accountants, that you have a total of 34,699 customers on this residence lighting rate. Therefore, the coupons received showing a preference for the old rate amount to 2/10 of 1 % of the total customers concerned.

Very truly yours,

Richard J. Kinsella
MAYOR

We are pleased that the above letter from His Honor, the Mayor confirms our opinion that the great majority of our customers are satisfied that our new 6c. rate is now operating or will soon operate to their advantage, as we promised it would, and therefore it will be continued.

We have thereby succeeded in making a low power rate available in every room of each of our 34,000 customers' homes without an expenditure on their part of at least $50 each for the installation of a separate power circuit.

We are not, however, content that there should be even as many as 2-10 of 1% of our customers who are not pleased, as we aim to give 100% satisfactory service. We have, therefore, filed with The Public Utilities Commission two (2) options to our 6c. residential rate, as follows:

1—For any use:
10c. per k. w. hr.—No area charge.
Minimum bill **$1.00** per month.

2—For cooking (including light and other household uses):
2c. per k. w. hr.—Area charge 12c. per 100 sq. ft.
Range charge—**50c.** per k. w. installed.

With these three household lighting rates of **10c, 6c, and 2c.** for our customers to choose between, every one can be satisfied, and we can accomplish our aim, which is to render good service to the public with 100% of good-will on both sides.

THE HARTFORD ELECTRIC LIGHT COMPANY
266 Pearl St. 2-0131

FIG. 4—ADVERTISEMENT OF RESULTS OF REQUESTS FOR FORMER RATE AND ANNOUNCEMENT OF TWO ALTERNATE RATES

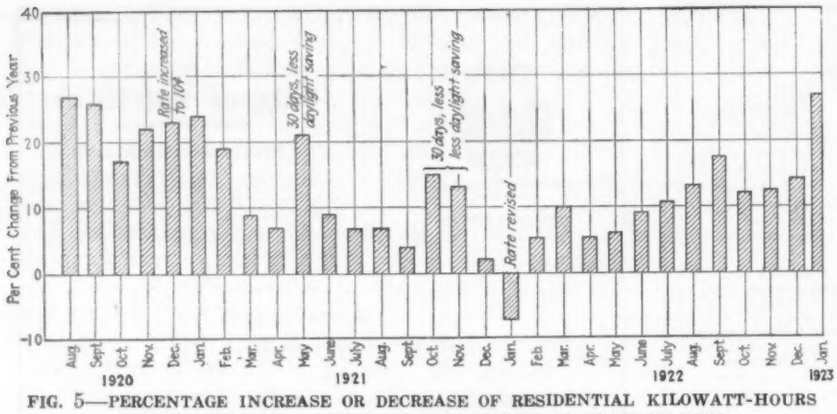


FIG. 5—PERCENTAGE INCREASE OR DECREASE OF RESIDENTIAL KILOWATT-HOURS CONSUMPTION OVER CORRESPONDING MONTH OF PREVIOUS YEAR

would be made either to the 10-cent rate or, if conditions warranted, to such lower rates than 10 cents as costs at that time would justify. It was also pointed out that the new rate meant immediate losses to the company, but that it was expected it would make possible wider uses of electricity which would recoup that loss. Window cards, bill inclosures each month, charts and appliance exhibits in the sales office, "cents-per-hour" meter equipment, notices regarding the greater use of lamps and other forms of advertising were used to impress the public with the possibilities of the new rate.

The promise to give the new rate a year's trial with the alternative of a restoration of the former or a diminished rate in case of dissatisfaction made an instant appeal to the Hartford press, and the company received very favorable editorial comment to the effect that the rate was a fair proposal. The very same papers which were hostile to a uniform service charge of the gas company, though they declared that this was another form of service charge, urged giving it a trial.

There were many customers who objected at the outset to the new rate and quite a number whose total bills were increased. These were of the opinion in some cases that the company was trying to "fake" an advance on the community in the guise of a reduction. They were answered by a coupon (Fig. 2) on every appliance sold during the year which stated that the company would refund them the total amount that their bills were increased during the year by the new rate on the purchase of any appliance made during the year. If their bills were increased $3 and they bought a five-dollar flatiron, they would get a credit of $3 on the iron at the end of the year. About 350 of these coupons were sent back for a refund, if any was due, and of these coupons the company paid out $204 in refunds on about fifty of the coupons. The other 300 received a note stating that the company was glad to see that the rate had worked so much to their advantage during the year. In these instances the increased consumption due to the use of appliances purchased had effected a lower rate in favor of the customer.

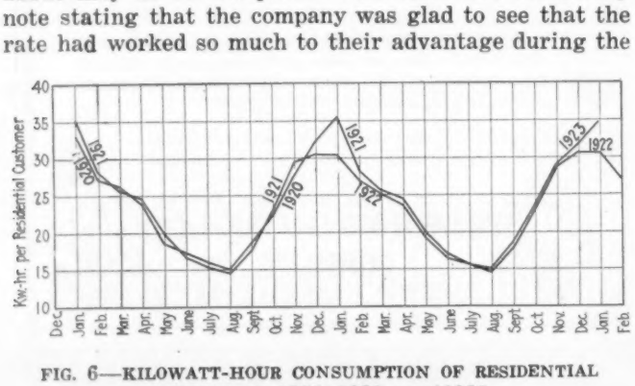


FIG. 6—KILOWATT-HOUR CONSUMPTION OF RESIDENTIAL CUSTOMERS, 1920, 1921 AND 1922

THE FIRST MONTH'S RESULTS

The two-part rate was put into effect in January, the month of the greatest use. For that month, if the energy had been billed at the old 10-cent rate, the company would have billed about $90,000; actually it billed $73,000. The number of bills increased was 5,342 and the number decreased was 23,345. The total amount of the increases for the first month was $1,007 and of the decreases $17,938. The smallest bill decreased was 92 cents and the largest bill increased was $16.68. The average rate received was 8.1 cents per kilowatt-hour. In a press statement discussing the first month's experience the company pointed out that it was sure that those who were not then making at least an average use of the benefits of electricity in the home were paying to others for coal, oil, gas or labor far more money than if they had hired the company at the new energy price of 6 cents to perform a greater amount of service far more conveniently for the user.

It was a great surprise to the company to find so much "dead wood" on its lines as the five thousand customers whose bills were increased represented. Those customers whose rates had been increased had been a drag on the costs of serving the community with electric light and power. The small customers *per se* are not "dead wood," the use of the service being the criterion, in conjunction with the load factor of each installation.

An analysis of these same customers' accounts in January, 1923, after a year's experience with the rate, showed that almost 60 per cent of them had so increased their use of energy that they had become gainers under the rate and could no longer be classed as "dead wood."

Measurements of areas were taken from the Sanborn insurance or assessors' maps, and after the first month's billing customers were invited to check up their areas with the company's computations for correction by the latter in case of inaccuracy. Resurveys resulted for about 10 per cent of the total residence customers.

PUBLIC INVITED TO REGISTER DISSATISFACTION

The climax of the first year's use of the rate came in the insertion by the company of a letter form (Fig. 3) in the local newspapers addressed to the Mayor of Hartford, by the use of which customers dissatisfied with the combination rate might indicate their preference for the former 10-cent rate. With this letter form was published a statement signed by Mr. Ferguson, thanking the public for its fair trial of the new rate and pointing out that the public had paid $97,724 less for the total of its household electric bills in 1922 than it would have paid if billed under the old rate. At the close of the year there were only about 25 per cent as many complaints on bills as under the old rate, and the reduction in the cost of electricity had made possible a greatly increased use of labor-saving appliances in the home. To keep its word about offering to restore the old 10-cent rate and to make sure that it had not misjudged public sentiment, the coupon letter to the Mayor was published. This advertisement was run

for nearly a week. The Mayor agreed to tell the company the number of complaints received, and in a letter (Fig. 4) he conveyed the extraordinary information to it that from 34,599 residence lighting customers only sixty-seven coupons expressing a preference for the old rate were received. This represented only about two-tenths of 1 per cent of the total customers concerned.

However, in order that even this small percentage of customers might be satisfied, the company announced in its advertisement (Fig. 4) two options to the 6-cent rate: First, for any use, 10 cents per kilowatt-hour, with no area charge but with a minimum bill of $1 per month; second, for cooking (including light and other household uses), 2 cents per kilowatt-hour plus an area charge of 12 cents per 100 sq.ft. per month plus a range charge of 50 cents per kilowatt installed. It is interesting to note that only twenty-seven customers availed themselves of the 10-cent option.

A diagrammatic story of the effect of the combination rate is told in Figs. 5 and 6.

This story extends back to August, 1920, and shows the condition existing under the old form of rate previous to and after its increase. The result of the earlier increase in rate to 10 cents, necessitated by high fuel costs, etc., was a marked decrease in the percentage of monthly consumption increases, after the first two months' use. May, October and November of 1921 show the effect of changes due to the daylight-saving shifts and to a shift in the latter two months of meter-reading dates that should be averaged over the months before and after to get a true picture.

The first month of the new rate, which covered the energy used in December before its announcement, shows a loss in residential consumption, but since this time the gain has been fairly uniform. At the expiration of the year the rate of gain of two years previous had been re-established and the per-customer use of current had increased 20 per cent up to March 1.

The consumers of Hartford have been convinced that the new form of rate is to their advantage, and the story of this rate and its introduction shows that the difficulties which many central-station men have feared as a result of an attempt to employ such a combination rate have not materialized. The use of this form of rate is being taken up and effectively applied in many other parts of Connecticut.

THE SKY BRIGHTENS FOR RESIDENTIAL SERVICE

In closing, Mr. Ferguson's advice to central-station companies as presented at the Worcester meeting previously mentioned is of interest. Referring to the psychological aspects of rate modification, he said: "Take advantage of your present strategic position with the relatively high domestic rate to remove the resistance of wiring costs in the method outlined, and then see to it that your salesmen go at their work with enthusiasm and the feeling that the company is behind them in their efforts and that it expects them to make good. And when they have made good and we are serving a fully electrified customer for every four and a half of our population, we will supply for residential use not less than 150 kw.-hr. per capita per year instead of the present insignificant amount, which seldom exceeds 60 kw.-hr. per capita and in many places is as low as 20 kw.-hr. per inhabitant. And when we add to this the cooking and refrigeration possibilities, we cannot but feel that our industrial salesmen will have to look sharp or they will be completely outdistanced."

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

High-Voltage Cables in Holland

To the Editors of the ELECTRICAL WORLD:

I noted with interest the letter of D. M. Simons in the issue of Dec. 2, 1922, page 1217, stating the difficulty of obtaining exact information about foreign high-voltage cables, and I am glad to be able to afford you some details about the cables used in Holland. The company of which I am chief engineer uses both single and three-core 50,000-volt cables. The former are Siemens cable, the latter manufactured by the Callender Works in England. Both kinds of cable are operated at 10,000 volts pending the arrival and installation of 50,000-volt substation apparatus.

The statement that the three-conductor cable developed considerable difficulties is not correct. Operation at 10,000 volts gave no difficulties at all. With 50,000 volts we have not yet had experience, but severe tests lately made have led us to expect that there will be no trouble with this voltage either. We intend to start the 50,000-volt service within three months, and the results will be made known in due time.

W. L. C. BRUNINGS,
Chief Engineer.

Prov. Electriciteitsbedrijf van Noord-Holland,
Haarlem, Holland.

Sludge Formation in Transformer Oil and Solubility Thereof

To the Editors of the ELECTRICAL WORLD:

The experience of naphtho-chemists has shown that transformer oils in contact with air produce sludge very slowly at any operating temperature below 75 deg. C., provided that the oil is of good quality and no catalysts are present. At the operating temperatures above this point the sludge formation is materially increased. Laboratory practice has shown that an accelerated test can be carried on conveniently at 150 deg. C. (Scientific Paper No. 112-B reviews a number of such practical tests.) Consequently a series of tests upon a certain representative transformer oil were made to ascertain the effect of heat in producing a more sludgable oil. The greater the amount of unsaturated constituents present within the oil, the shorter the life becomes because of the greater tendency to form deposits.

Oil was heated at 144 deg. C. for three days. A small portion was taken, allowed to cool, diluted with an equal portion of petroleum ether and allowed to stand a day. The sludge was separated upon a Gooch filter and the filtrate treated by the Babcock absorption method for unsaturated constituents. Portions of the oil were sampled at intervals and tested in a similar manner. The results appear in the following table:

Kind of Oil	Hours Heated	Temperature (Deg. C.)	Unsaturated Constituents (Per Cent)
Transformer oil	No	25	6.9
Flash, 141 deg. C.	72	144	10.0
Viscosity, 50	174	148	13.1
Saybolt seconds	384	148	15.0
	452	148	21.2
	650	148	23.6

After 650 hours' heating at 148 deg. C. the oil became thick and full of sludge. If the oil is filtered hot, without dilution, not all the sludge can be separated. If allowed to stand two weeks with no initial filtration, the sides of the containing vessel become heavily coated with sludge and some varnish.

It is a significant fact that parallel runs similar to those shown in the foregoing table were made with nitrogen and carbondioxide, and no sludge was formed. In parallel tests, but with a float arranged within the container, closely fitting along the sides thereof and floated upon the surface of the oil, only a slight coloration of the oil was noticeable.

Sludge-free oil dissolves only a very small amount of sludge. Very finely divided deposit which had been freed from oil by several naphtha extractions was shaken up with a high quality transformer oil ("Wemco A") at various temperatures and held there while shaking for one hour. The sludge was filtered off, washed, weighed, and the percentage of solubility calculated. Results of these tests are given below:

Sample No.	Temperature (Deg. C.)	Solubility of Sludge in Oil (Per Cent)
1	12	0.001
2	21	0.003
3	63	0.010
4	105	0.013
5	145	0.021

It is obvious from the above data that the oil-forming sludge tends to create a deposit upon the cooler parts of the transformer.

C. J. RODMAN,
Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Electrical Energy on the Farm

To the Editors of the ELECTRICAL WORLD:

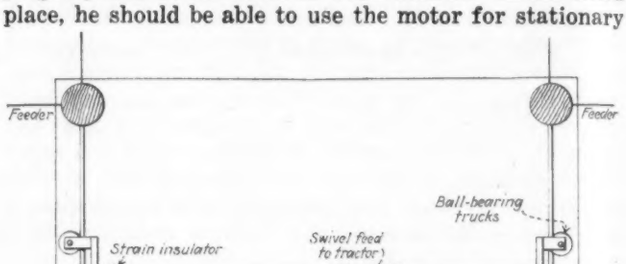
I read with considerable interest your article on the uses of electrical energy in agriculture and, having myself given the subject considerable attention, I should like to present my views.

The suggested equipment, I believe, is somewhat impracticable, considering that plowing constitutes probably only 20 per cent of the entire power work on a cultivated crop. With any cable-haulage system or with a trailing cable the damage done to the crops would prohibit use of the system.

I think a system such as I have outlined in the accompanying sketch would be superior inasmuch as the tractor can move anywhere in the field without changing any of the gear, as must be done with electric drive to compete with the present kerosene tractor. The cables carrying the trolleys can be made of ½-in. standard galvanized guy cable, which will have carrying capacity enough for the purpose. The motor in the tractor need not be of more than 15 hp., which with any kind of economical gearing will give a net pull at the drawbar of 8 hp. The trolley on the tractor is so built that it can make a complete swivel. The two trolley wires have a wide space to prevent short circuits, and the trolley trucks have four wheels, which should be ball-bearing the same as those of the trucks that carry the trolley wires.

I think it is possible to care for a field of 10 acres with the above system, and with proper planning the steel cable for one side of the field can be made to carry the trolley for the adjacent field.

A farmer, contrary to the seemingly popular opinion, has considerable discernment and must be shown that his initial investment is not going to be so high that he can run a kerosene tractor on the interest. An outfit which will satisfy the farmer, therefore, is one where, in the first place, the initial cost is low. In the second place, he must be able to run it all over his property and do all kinds of work with it. In the third place, he should be able to use the motor for stationary



THE TRACTOR CAN MOVE ANYWHERE IN THE FIELD WITHOUT CHANGE IN CONNECTIONS

work in a way which will compare favorably with results from the kerosene tractor.

The central-station company should be alert and use its influence to make electricity possible for the farmer, and this cannot be done till there is some equipment produced that the farmer can use. The central station should figure on not more than a dollar per day for every horse displaced during the active season, which would give $8 a day for the outfit I have suggested, a fairly attractive figure for a 15-hp. motor.

Inspiration, Ariz. RICHARD GIBBS.

The World's Second Largest Reservoir

To the Editors of the ELECTRICAL WORLD:

In your issue of Jan. 20, 1923, page 179, there is in the statement of Ambassador Gelasio Caetani a little inaccuracy which I beg to correct. Under the heading "Electrical Development in Italy," the Ambassador states: "On the Tirso in Sardegna a reservoir with 416,000,000 cu.m. capacity is being constructed. It will be the second largest in the world, ranging immediately after Assuan Dam, and will develop 50,000,000 kw.-hr."

The Møsvand Reservoir in Telemarken, Norway, furnishing power for the two Rjukan plants belonging to the A/S Rjukanfos of the Norsk Hydro-Elektrisk Kvælstofaktieselskap (Norwegian Hydro-Electric Nitrogen Company) of Norway, has a dam height of 14.5 m., a capacity of about 768,000,000 cu.m., and gives water sufficient to generate from 1,700,000,000 kw.-hr. to 1,800,000,000 kw.-hr. from a total utilized head of 536 m. This reservoir, therefore, still ranges next to the Assuan Dam.

WILHELM FLEISCHER,
Supervising Engineer.
Norsk Hydro-Elektrisk Kvælstofaktieselskap,
Christiania, Norway.

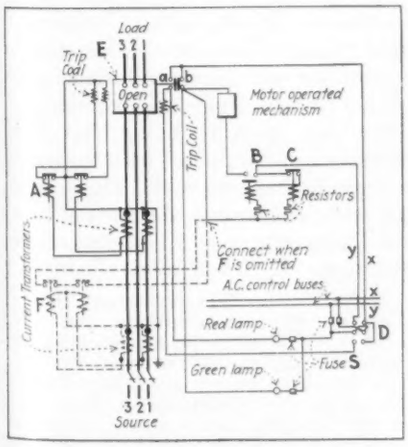
Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of
Generation and Distribution Equipment, and Methods of Economically Utilizing
Electric Service in Large Industrial Plants

Auto Reclosing Switches at Remote Substations

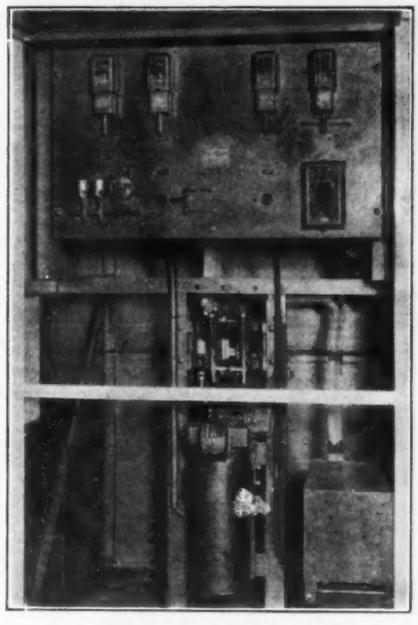
AT REMOTE substations, where the continuous attendance of an operator is not justified, the Tennessee Electric Power Company is installing automatic reclosing circuit breakers which operate on alternating current taken from the transmission lines. Hence no storage batteries are required. Such stations have already been installed at Athens, Sweetwater and Lenoir City. The control connections for the breakers, which are General Electric type, are shown in the accompanying diagram, while the simplicity of the Athens substation is shown by the photograph.

When a short circuit or overload beyond the setting of the overload relay *A* occurs, this relay operates with an inverse time characteristic and trips out the oil circuit breaker. The opening of the breaker closes auxiliary switch *b*, energizing the reclosing relay *B* and the notching relay *C*. After a definite time interval the former closes its contacts and starts the motor, which recloses the oil circuit breaker. At the same time the notching relay moves up a step and will begin resetting as soon as the breaker closes.



AFTER CLOSING SWITCH TWICE THIS EQUIPMENT BECOMES INOPERATIVE

A—Overload time-delay relay. B—Reclosing relay, time-delay closing, instantaneous opening. C—Notching relay. D—Control power switch. E—Oil circuit breaker and mechanism: (a) Auxiliary switch, open when main switch is open; (b) Auxiliary switch, closed when main switch is open.



SIMPLICITY OF CONTROL APPARATUS FEATURE OF AUTOMATIC RECLOSING EQUIPMENT

If the trouble has not cleared from the line by the time the breaker is closed, the overload relay will open it again and the same cycle will be repeated, the notching relay moving up another step. If the trouble still continues the breaker will open a third time, and further automatic operation of the equipment will be prevented by the notching relay, which opens its contacts on the third step and must be reset by hand before operations can be resumed.

The circuit shown by the dotted lines is a further protection which may be incorporated if desired and which locks the breaker open in case of severe short circuits that are beyond the interrupting capacity of the oil circuit breaker. By throwing the control switch *D* to the down position, the breaker is tripped, and it cannot be closed with the switch in that position. This feature assures the safety of anyone inspecting the breaker and equipment. Throwing the control switch to the upper position causes the automatic operation of the breaker to be resumed.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Adjustable-Speed Drive for Steel Mills

TWO adjustable-speed units aggregating 1,000 hp. for steel-mill drive, embodying some very recent developments, are described in the recent report of the iron and steel industry committee of the A. I. E. E. The main drive in these units consists of a mill-type induction motor with a direct-connected synchronous machine on the same base.

The auxiliary machine consists of a frequency converter driven by a synchronous motor. In the operation of the equipment no torque is developed by the frequency converter and the driving motor supplies the power for windage and friction of the auxiliary set. In the operation and during regulation the secondary of the main induction motor is connected to the commutator of the frequency converter and the slip rings of the frequency converter are connected to the synchronous machine connected to the mill. This machine has the property, when driven at synchronous speed, of taking the frequency impressed on the commutator and adding to or subtracting from the line frequency, which in this case is the secondary frequency of the induction motor. The voltage delivered at the commutator end of the frequency converter is the same voltage as that impressed on the slip-ring end and as supplied from the synchronous motor. The synchronous machine on the main set and the synchronous driving motor for the frequency converter are excited with direct current.

After starting the main motor in the regular way as an induction motor, the secondary circuit is transferred to the frequency converter. This is done with no field on the synchronous machine and with the frequency converter running at synchronous speed. If it is desired to use a speed other than the normal, the rheostat in the synchronous machine field is manipulated, putting a field on this machine.

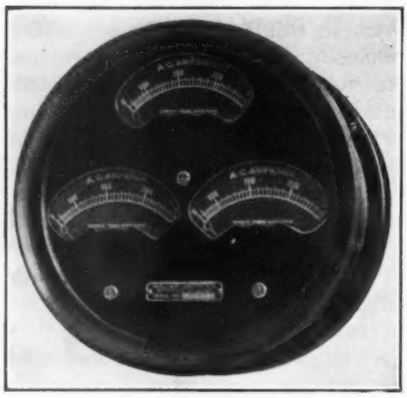
This causes the synchronous machine to generate a certain voltage which is transmitted through the frequency converter and impressed on the secondary of the main induction motor. This voltage, according to whether it opposes or helps the generated secondary voltage, causes the set to slow down or speed up. Any speed within the speed range can be obtained by simply adjusting the above-mentioned field rheostat, giving the desired practical range of speed above and below normal or induction motor speed.

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Triplex Ammeter Used for Three-Phase Circuits

THE installation of ammeters on three-phase circuits is often governed by the available switchboard space and the expense involved. The use of an ammeter switch with only one ammeter is apt to cause interruptions to service when ground relay protection is installed. The West Penn Power Company has had developed in accordance with its specifications a triplex ammeter, such as is shown in the accompanying illustration, which has the following outstanding features:

1. It is possible to take readings in the three phases simultaneously as contrasted with the usual scheme of having one ammeter and throwing it from one transformer secondary to another by means of the conventional jack.
2. It occupies much less space than three individual ammeters.
3. It possesses all the advantages of three individual ammeters in that any



COMBINING OF THREE AMMETERS SAVES SPACE ON THREE-PHASE SWITCHBOARD

one of the three mechanisms can be reversed if necessary.

4. Each element is thoroughly insulated from the others.
5. Each element has its own zero adjuster.
6. While developed particularly for high-tension metering circuits, the triplex ammeter is being used in low-tension three-phase circuits in connection with suitable current transformers.
7. It is possible to keep three-phase circuits more evenly balanced as a result of such an ammeter, thereby tending to prevent overload interruptions which often occur.
8. The use of three individual elements tends to keep secondary circuits more evenly balanced.
9. Continuity of secondary circuits is more reliable than with some types of ammeter jacks which are apt to cause interruptions, especially when using ground relay protection.
10. High overload capacity.
11. Accuracy well within any desired value for such service.
12. Any one of the three elements may be removed without interruption to the circuit.
13. When used in large quantities the replacing of the new element is about as economical as making repairs.

The details of this instrument are as follows: The elements are of the electromagnet type, in which an efficient air damping scheme is used. All three elements are mounted on one rigid bakelite base, thus insuring proper insulation and providing against misalignment of parts, and in addition there is a bakelite barrier between each two elements. The over-all diameter is 7½ in. and the depth (not including studs) is 3½ in. Connections are in the form of rear studs, of which there are six, so arranged that they cannot turn.

In mounting the instrument it is necessary to drill six holes for the studs. These studs also serve to hold the instrument in place. The whole structure is dust-proof, moisture-proof and practically waterproof. Each scale is about 2¾ in. long. The scales are readable from about 20 per cent to 100 per cent of full-scale value. The average net weight per instrument is 5½ lb.

H. A. P. LANGSTAFF,
Relay Engineer.
West Penn Power Company,
Pittsburgh, Pa.

Extracts from an Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Instructions for Operating Forced-Draft Fans

FORCED-DRAFT fans should be started under minimum load by having the damper closed when starting. This also prevents the furnace gases from being forced out of the side doors if the stack damper is not properly set. The main oil switch should be used only for the purpose of disconnecting electrical energy from fans, and if it automatically trips, then something unusual has happened which requires the attention of an electrical mechanic before starting the fans again. The following instructions for starting and shutting down forced-draft fans have been taken from the operating code of the Philadelphia Electric Company:

STARTING FORCED-DRAFT FANS

1. See that the forced-draft damper is closed.
2. Turn on the cooling water to the bearings.
3. Start the turbine or motor.
4. Inspect the oiling system and see that the gear case contains the proper quantity of oil and that oil rings, pumps, etc., are in operation.
5. Bring the unit up to speed.
6. Inspect the unit for excessive vibration, and if excessive vibration is discovered, report the trouble to the shift superintendent.
7. If the main oil switch (controlled at the boiler operating boards) should trip, have an inspection made by the electrical mechanic and any trouble corrected before closing again.

SHUTTING DOWN

1. Shut down the turbine or motor.
2. Turn off the cooling water.
3. Close the forced-draft damper.

Testing Reverse-Current Trips

ACCORDING to the operating code of the Philadelphia Electric Company testing reverse-current trips on rotary converters and motor-generators should be done under the direct supervision of the substation supervisor or foreman. The only time that this test can be made is when the machine being tested is running in parallel with another source of direct current. The following instructions as abstracted from the above code should be followed for this test:

1. Cut in the field resistance slowly, observing the direct-current ammeter, until the reverse-current trip opens the circuit breaker. When the reverse-current relay is set at a high value, disconnect it mechanically from the circuit breaker, reverse the potential leads and load the machine until the relay operates. Reduce the load on the machine to zero. Trip the circuit breaker manually, using the reverse current tripping device.
2. Observe, if possible, the amount of reverse current which operates the trip.

Test of Boiler Fired with Powdered Coal

A PRELIMINARY statement regarding the results of tests carried out at the Lakeside Station of the Milwaukee Electric Railway & Light Company by the fuel section of the United States Bureau of Mines, in co-operation with the research department of the Combustion Engineering Corporation of New York, has been issued by the Bureau of Mines. The main object of these tests was to determine the thermal efficiency, ease of operation and other particulars of a boiler equipped with specially designed furnace and burners for burning powdered coal. The boiler tested has 13,380 sq. ft. of heating surface and is one of eight boilers equipped with the Lopulco powdered coal system supplying steam to two 20,000-kw. turbines.

Twenty-six tests were run at rates of heat transference varying from 4,000 B.t.u. to 8,000 B.t.u. per square foot of boiler-heating surface, and the mean thermal efficiency attained was about 84 per cent, based on the gross calorific value of the fuel as fired. The efficiency varied little with the rate of steaming and its high value is accounted for by the small loss from incomplete combustion and the small amount of excess air, which varied from 5 per cent to 36 per cent.

The coal burned had a gross calorific value of from 11,500 B.t.u. to 12,800 B.t.u. per pound, containing 2 per cent to 5 per cent moisture, 33 per cent to 36 per cent volatile matter and 9 per cent to 13 per cent ash, and was so grounded that 89 per cent to 95 per cent would pass through a 100-mesh sieve. The ash had a softening point of 2,150 deg. to 2,450 deg. F., but did not fuse together at the bottom of the furnace because it was partly protected from the flame radiation by means of a series of water tubes connected to the boiler which were placed between the furnace bottom and the flame. A summary of the results of boiler tests is given in the accompanying table.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

RESULTS OF BOILER TESTS AT LAKESIDE POWER STATION, WHERE POWDERED COAL IS USED THROUGHOUT

Test Number	Duration, Hours	Per Cent Rating Based on Heat Absorbed by Boiler and Superheater	Per Cent Efficiency Based on Gross Calorific Value: Boiler and Superheater	Per Cent Efficiency Based on Gross Calorific Value: Boiler, Superheater and Economizer	Per Cent Efficiency Based on Net Calorific Value: Boiler and Superheater	Per Cent Efficiency Based on Net Calorific Value: Boiler, Superheater and Economizer	Temperature, Deg. F.: Gases Leaving Boiler	Temperature, Deg. F.: Gases Leaving Economizer	Temperature, Deg. F.: Superheated Steam	CO_2, Per Cent: Gases Leaving Boiler	CO_2, Per Cent: Gases Leaving Economizer	Coal: Moisture, per Cent	Coal—Size: Through Screen, 100 Mesh	Coal—Size: Through Screen, 200 Mesh
1	42.33	137	83.3	86.4	86.6	89.8	436	170	547	15.8	10.4	2.2	89	68
2	23.97	216	82.6	87.1	86.1	90.8	470	195	592	14.6	11.9	3.6	91	69
3	19.92	210	82.5	87.1	85.9	90.7	484	204	598	14.7	12.0	3.9	91	69
4	24.37	144	85.3	89.1	89.0	93.0	432	205	529	16.0	13.2	5.6	92	71
5	24.17	236	79.7	84.4	83.1	88.0	500	254	590	14.1	10.8	5.7	91	67
6	28.25	139	83.4	87.6	86.8	91.1	456	229	554	15.1	11.4	3.7	92	68
7	25.57	178	84.0	88.4	87.3	91.9	469	240	561	14.7	11.2	3.5	93	66
8	24.00	176	85.1	89.5	88.5	93.1	470	239	558	15.0	11.4	3.5	92	63
9	24.28	205	83.9	88.4	87.2	91.9	493	256	572	15.1	9.9	2.8	94	73
10	24.62	204	83.4	87.3	86.6	90.7	490	256	565	14.7	10.5	3.5	90	58
11	24.08	243	81.6	86.4	85.0	90.0	535	286	592	14.0	10.2	3.7	95	69
12	23.92	241	82.3	87.0	85.6	90.5	528	263	595	14.3	11.3	4.1	93	69
13	24.25	248	80.9	85.5	84.2	89.0	538	272	601	14.2	9.8	3.6	93	70
14	24.50	130	84.5	88.3	87.9	91.8	440	218	521	17.1	14.7	3.2	93	65
15	17.63	136	84.7	88.8	88.0	92.3	444	221	538	16.4	14.0	3.6	92	65
16	24.15	251	83.8	88.8	87.4	92.6	530	256	612	14.8	11.2	5.5	91	68
17	23.45	238	82.3	87.6	85.7	91.2	528	268	605	14.1	9.9	4.9	92	65
18	24.67	257	82.1	86.9	85.4	90.4	526	269	594	14.9	10.9	3.4	93	70
19	27.38	256	82.8	87.6	86.1	91.0	519	262	588	15.0	11.6	3.1	93	64
20	26.67	251	79.5	84.5	82.6	87.8	545	306	594	13.9	11.8	2.2	92	67
21	23.93	175	86.9	91.3	90.3	94.8	468	260	563	15.6	13.8	2.2	93	72
22	24.42	167	86.2	90.4	89.5	93.9	463	264	564	15.7	13.7	2.5	92	70
23	24.83	233	81.8	86.2	85.0	89.6	526	298	595	13.7	11.4	2.8	92	57
24	25.00	224	81.2	85.9	84.4	89.3	512	294	588	13.1	10.9	2.8	91	69
25	24.03	170	85.4	89.3	88.8	92.9	464	254	562	15.7	13.9	3.5	92	66
26	25.55	166	86.0	89.9	89.4	93.4	459	252	566	15.4	13.6	3.4	92	70

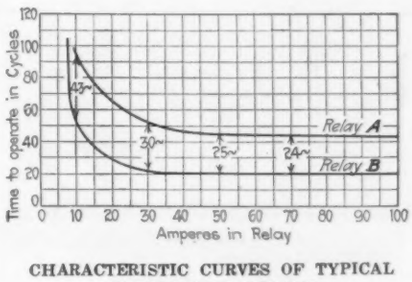
Note—No time elapsed between tests which are bracketed together.

Checking and Calibrating Relays in Place*

Selecting Suitable Locations for Relays—Precautions to Be Considered Before the Actual Placing of Various Types of Protective Devices Into Service

IT IS important that relays be installed in a clean part of the station where there is plenty of light, minimum vibration and suitable temperature conditions. The relay equipments of the different lines or apparatus should be grouped on the panels at the proper height and clearly designated in order to facilitate thorough testing and inspection without accident of any sort such as operating a relay of equipment other than that being tested, from which serious consequences might come.

Generally speaking, there is not enough difference in temperatures of stations, except those of the outdoor type, throughout the year to be of serious consequence in affecting the operation of the relays. The temperature question should, however, receive consideration where relays are installed in unheated inclosures used with outdoor substations and required to function selectively with others in stations heated in the usual manner. It is possible that the error produced by a given change of temperature will affect different types of relays in different ways; that is, on one relay it may increase the time of operation and on another decrease the time. It would seem advisable not to install relays of the bellows type where they will be subjected more or less continuously to excessively high temperatures, on account of the likelihood of drying out the leather, with the consequent inaccuracies of operation.



CHARACTERISTIC CURVES OF TYPICAL OVERCURRENT RELAYS

Relay A — 8-amp. starting current; 50 amp. for opening within 45 cycles.

Relay B—6-amp. starting current; 50 amp. for opening within 20 cycles.

Each relay equipment should be provided with facilities for opening the current circuits in such a man-

*This article, describing suitable locations for relays and outlining methods for checking and calibrating relay installations, is a continuation of the article printed in the Feb. 10 issue of ELECTRICAL WORLD, page 338.

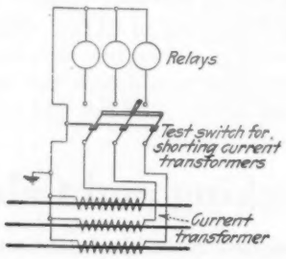
ner that the current transformers will be short-circuited and the relay terminals be available so that connections for calibration can easily be made. This device can be made up in the form of a knife switch with short-circuiting clips and test terminals placed in a small box, which can be locked if desired. When relays make use of potential, fuses can be used for protection and for the purpose of disconnecting the source of voltage. These current or potential cut-outs should, of course, be grouped with the relays or else clearly designated so that no mistake will be likely to be made in opening the circuits.

It will be found very convenient to have a source of alternating current of 110 volts or 220 volts available near the relay equipments to use for testing and calibrating purposes.

After the relay wiring on any given installation has all been completed, the correctness of connections can be checked by opening the circuits and talking over the various wires through the use of head telephones. It is generally not advisable to make tests of this sort by the use of a telephone receiver and battery depending upon a click in the receiver as an indication of completed circuit as the capacity between leads will often give a false indication. After all the wiring has been checked in this manner additional checks should be made on most types of installations to make sure that everything is correct.

In addition to the above, excess-current relays should be operated electrically, making use, if desired, of a small alternating-current test set such as was described in the previous article referred to in the footnote on page 925.

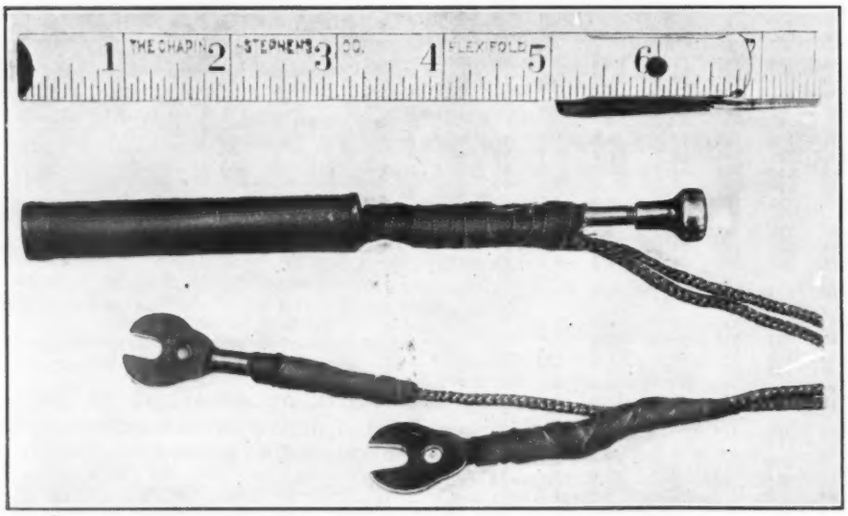
Directional (reverse-power) relay installations should be checked under load conditions to make sure that phase relations, etc., are correct and that the contacts are open with the normal direction of energy transfer. A device which may be used for this is described in the above-mentioned article.



MAKING RELAY TERMINALS AVAILABLE FOR TESTING PURPOSES

Double-winding differential relays such as are used for the protection of transformer banks may be checked for balance by removing the relay core and placing therein a test core provided with a winding which is connected to a voltmeter. If under load conditions an exact balance does not exist in the relay, a voltage will be induced in this winding and indicated on the voltmeter. This method of checking differential relays leaves nothing to be assumed and can be carried out without removing any electrical connections.

It should be kept in mind that the value of differential-relay protective systems lies to a great extent in their ability to isolate defective equipment quickly, and auxiliary relays or any factors which increase operating time appreciably are to be avoided.



TEST CORE USED WITH DIFFERENTIAL RELAYS MADE WITH 700 TURNS OF NO. 31 WIRE

After all tests have been made, care should be used to make sure that any circuits opened during the tests are properly closed and that the relays actually trip the circuit breakers as desired.

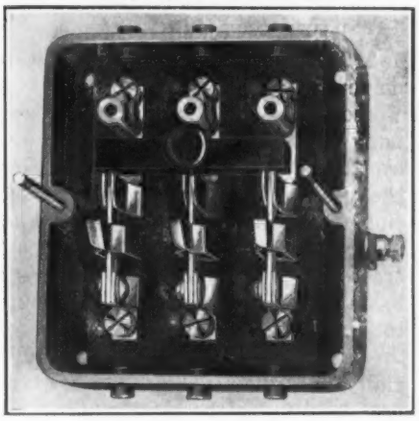
In developing methods for testing other types of relay installations than those described herein it should be kept in mind that it is inadvisable to use any method of test that requires extensive opening of circuits or changing of adjustments on account of the possible failure to restore them to their original condition at the end of the test. After it has definitely been determined that the relay protective system is in satisfactory operating condition, the relays should have their final setting.

In determining the exact time settings to be employed with excess-current time-limit relays it is generally considered that the relays with the minimum setting should have enough time delay so that they will not open the breaker under surges or troubles which do not require that that particular section of the system be isolated. This means that the relays which are set for minimum time will probably have an adjustment of 20 cycles (on the basis of 60 cycles per second and operation of the relay on the flat part of its characteristic curve). The relays with the next higher time setting, which must function selectively with these, should be set for about 45 cycles or 50 cycles. This time difference is made up as follows: After the first-mentioned relay has closed its contacts at the end of 20 cycles, the auxiliary relay will close its contact from 1 cycle to 5 cycles later, and an additional time of about 10 cycles or 12 cycles will be required from the instant voltage is impressed on the opening coil of the circuit breaker until the short-circuit current is actually opened.

The time for the breaker to open the short-circuit current must, of course, be included, as the relay with the higher time setting, which should not close its contact, keeps on moving closer to the point where its contacts close until the short-circuit current is actually interrupted. It is also advisable to include about 10 cycles additional time between the settings of the two relays to take care of any inaccuracies in the relays, errors in settings and sluggish opening of the circuit breaker.

It is advisable where relays of different types are used to function se-

lectively together that the characteristic curves be plotted according to the settings used so that the time difference under all conditions can be checked to make sure that selective action will really be obtained. The curves on page 925 show characteristic instances of typical relays plotted so as to show the time difference between the relay settings at various current values. This shows clearly the variation of time at the



SWITCH FOR SHORTING CURRENT TRANSFORMERS WHEN TESTING RELAYS

different points on the curve and the necessity for making sure that this time is sufficient at all points.

Every care should be used in making the final tests and inspections on relays to insure their functioning in the desired manner. It is almost impossible to overemphasize the need for exact work in connection with relay-protecting systems. If the person who inspects and adjusts relays is a keen observer, he may notice little things which are not quite as they should be that may lead to serious trouble if not corrected.

In a subsequent article it is planned to discuss routine tests and calibration of relays which should be made in order to insure that the relays will function properly.

RAYMOND BAILEY,
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Philadelphia Electric Company.
Philadelphia, Pa.

Blasting Post Holes Saves Hours

SOME interesting experiences in digging post holes in frozen ground for a light and power company are reported by Charles Van Zandbergen, Onalaska, Wis. Digging by hand, it required from eight to nine hours for one man to excavate a hole 6 ft. deep and 2 ft. in diameter. Mr. Van Zandbergen was able to accomplish the same work in a few minutes by the use of dynamite, using one stick of 40 per cent to break up the frozen ground and later three sticks to loosen it further down. A workman afterward trimmed the sides and cleaned the hole out, the entire operation with dynamite taking about one hour. Besides the great saving of time by the use of dynamite under these conditions, there was an appreciable saving of money.

FIELD EDITOR ELECTRICAL WORLD.
Chicago, Ill.

Sidelights on Electric Furnace Maintenance

AN ELECTRIC furnace with intelligent handling should last at least eight years, and perhaps twelve, against a life of four to six years for an oil furnace, according to a recent discussion before the Boston Section of American Society for Steel Treating. It was pointed out that whereas ribbon-type heating units are designed for continuous life at normal service, if burn-outs occur repairs can easily be effected by lapping the strips over one another a few inches and welding the edges only. If cross-welding is undertaken, the uniformity of the material may be disturbed at critical areas. It was also stated that the cost of replacing hairpin-type resistors is excessive in comparison with replacing ribbon-type resistors.

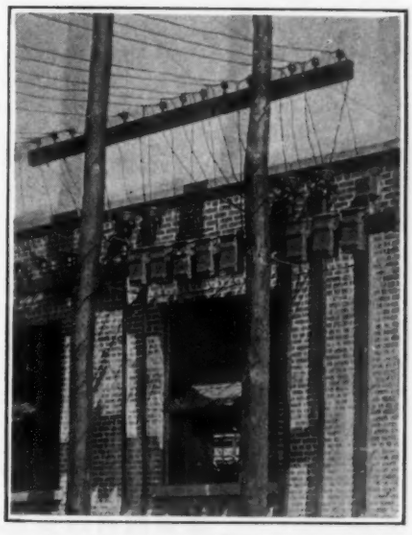
In the case of one rotary furnace with ribbon-type resistors mounted on the inside walls, the cost of repairs in three years' operation has not exceeded $25. No trouble was experienced from the scaling off and short-circuiting of coils unless very high temperatures considerably above 1,800 deg. F. were encountered. In some processes where about 2,000 deg. F. is required the furnace owner must be prepared at present to obtain a somewhat reduced life of ribbon-type resistors, this being about two months in one installation operated at 2,050 deg. F. Researches are now under way looking toward the development of resistor metal capable of operation at temperatures 300 deg. to 400 deg. above present conservative limits, and in due course there may be an advance of electric heating into the difficult fields of treating high-speed tool steel and even of forging. The advantages of electric heating in industry continue to spread. Gears formerly treated in fuel-fired furnaces in automobile manufacture had to be sand-blasted after heating. This frequently changed the shape of the teeth and always added to the manufacturing cost. Since the advent of the electric furnace it is necessary only to use the wire brush on such gears, with much better results.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

Ample Space Provided for Outgoing Lines

IN A SMALL power plant where the outgoing feeders consist of two two-phase, four-wire, 2,300-volt commercial feeders and two series street-lighting circuits an arrangement of the circuits as shown in the accompanying illustration provides plenty of room for the lineman to work on the lines or poles and presents a neat appearance. All the lines are accessible either from the roof or from the poles. As the ground is very sandy and loose the poles were tubbed and in addition they were bolted to the building. This gave a very rigid and safe construction.

From the switchboard the feeders run underground and are lead-covered cable in conduit. The two commercial feeders come up outside the building on one side of the window and the two series street circuits on the other. Graded shunt



ARRANGEMENT OF FEEDERS PROVIDES PLENTY OF ROOM FOR LINEMEN

resistance multigap arresters are provided for the commercial circuits and single-pole horn arresters for the series circuits. Separate grounds are provided for the arresters on the series circuits and the arresters on the commercial circuits.

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New York, N. Y.

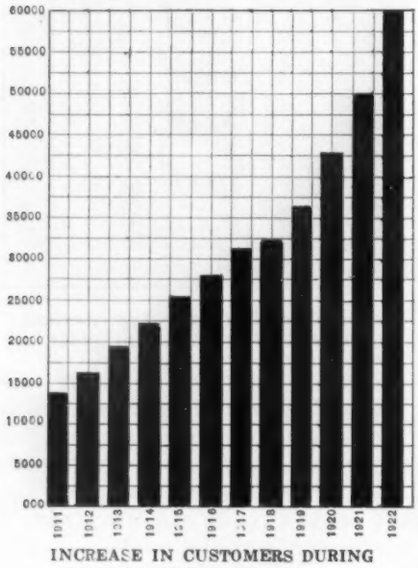
Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Central-Station Development at Providence

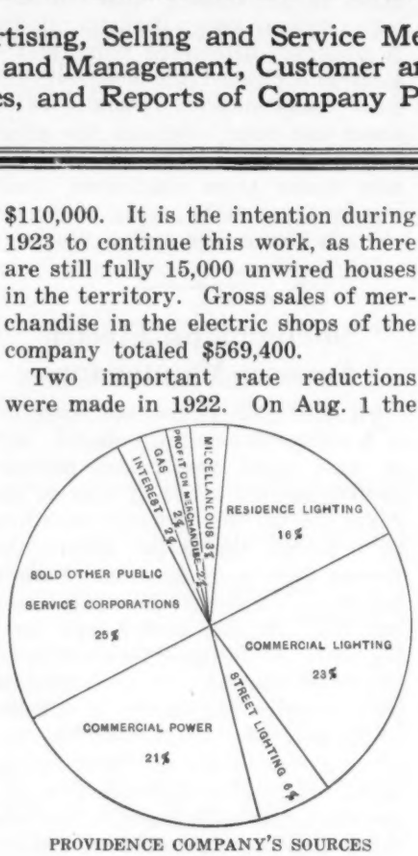
NOTEWORTHY expansion in the plant and service of the Narragansett Electric Lighting Company, Providence, is emphasized by President E. A. Barrows in his report to stockholders for 1922, and the excellent public relations of this, the second largest central-station company in New England, are also dwelt upon. During the year recently ended the total revenue was $5,574,825, a gain of over 10 per cent above 1921. The net income was $1,319,664, or more than 29 per cent above the preceding year and there was a gain of 20 per cent in station output, which reached a total of 277,993,260 kw.-hr. This output is nearly 300 per cent larger than it was six years ago. About $4 of capital is required for every dollar of new business obtained by this company.

The company has 59,985 customers, a gain of 10,176 during the year. This is the largest increase in customers in any year of the company's history. Old houses to the number of 2,462 were wired and stores to the number of ninety-nine in 1922, requiring the installation of 4,393 meters. The estimated gross revenue from this business alone is $110,000. It is the intention during 1923 to continue this work, as there are still fully 15,000 unwired houses in the territory. Gross sales of merchandise in the electric shops of the company totaled $569,400.



INCREASE IN CUSTOMERS DURING LAST TWELVE YEARS

Two important rate reductions were made in 1922. On Aug. 1 the clause in the schedule providing that no bills for house lighting should be less than 9 cents net per kilowatt-hour was eliminated, all electricity under this rate being sold for 7 cents per kilowatt-hour plus a monthly service charge of 50 cents. It is estimated that the elimination of this so-called "stop clause" will save the public about $140,000 during the first year. On Sept. 1 a further decrease from 7 to 6.9 cents per kilowatt-hour was made.



PROVIDENCE COMPANY'S SOURCES OF INCOME

The use of fuel oil was continued with marked economy during the year. Ninety-six per cent of the fuel used was oil and 4 per cent coal, the combined total being 188,506 tons. Of oil the company burned 942,244 barrels, and the company's customers were saved a large sum of money compared with the cost of service on a coal basis.

The company has begun gradually changing over its noted 250-volt lighting system to 104 volts. This change is planned in order that there may ultimately be a uniform voltage over the entire system, as is the case with the great majority of companies throughout the country.

House Wiring on Trial Booms Business

AGREEMENTS to the number of 997 for house wiring were made in 1922 on the system of the Edison Electric Illuminating Company of Boston, a gain of 95.8 per cent over the previous year. During the year a thirty-day trial installation feature was adopted, the financing of which was done by the contractors on a ten-monthly payment basis. This trial feature, according to L. R. Wallis, superintendent of the sales department, has aided materially in securing this class of business, and up to the close of the year not a single instance had occurred where a customer failed to accept the installation at the end of the thirty-day trial.

The total number of houses wired during the year under these agreements represented an outlay for wiring of $170,604, or an average price per house of $171.12. The average number of sockets per house was twenty-five, compared with twenty-two in 1921, and in the latter year the average price per house was $178.33. The total connected load added by these wiring jobs was 1,257.6 kw., yielding an estimated annual income to the company of $41,224. In 1921 509 houses were wired. Boston and Somerville led the other municipalities served by the company with 309 and 266 house-wiring agreements respectively. The contractor making the largest number of agreements was E. C. Sanderson of Winchester, who handled 330 contracts.

Advertising Security Sales on Company Letters

"CATCHY" sentences on the bottom of all outgoing letters form one of the methods of advertising the sale of its securities to customers recently used by the Central Indiana Power Company and its subsidiary companies in a customer-ownership campaign. Altogether

sixty-six of these sentences were used. A schedule was made up which started with No. 1 on a given day on all of the properties. The second day No. 2 was used, and so on for each succeeding day. Following are typical examples of the sentences. They were purposely made short enough to be read at a glance, aiming to hold the attention of the reader and make him ask for more information:

No. 1. Central Indiana Power Company owns electric companies operating in 103 communities in Indiana.

No. 2. Central Indiana Power Company's 7 per cent cumulative preferred stock nets better than 7.69 per cent on money invested.

No. 9. Central Indiana Power preferred stock can be purchased for cash or on partial-payment plan.

No. 16. Any employee of our company will be pleased to explain Central Indiana Power preferred stock.

No. 37. Central Indiana Power Company has paid forty-two consecutive dividends.

No. 43. Dividends on three shares of Central Indiana Power Company cumulative preferred stock will pay your light bill for a year.

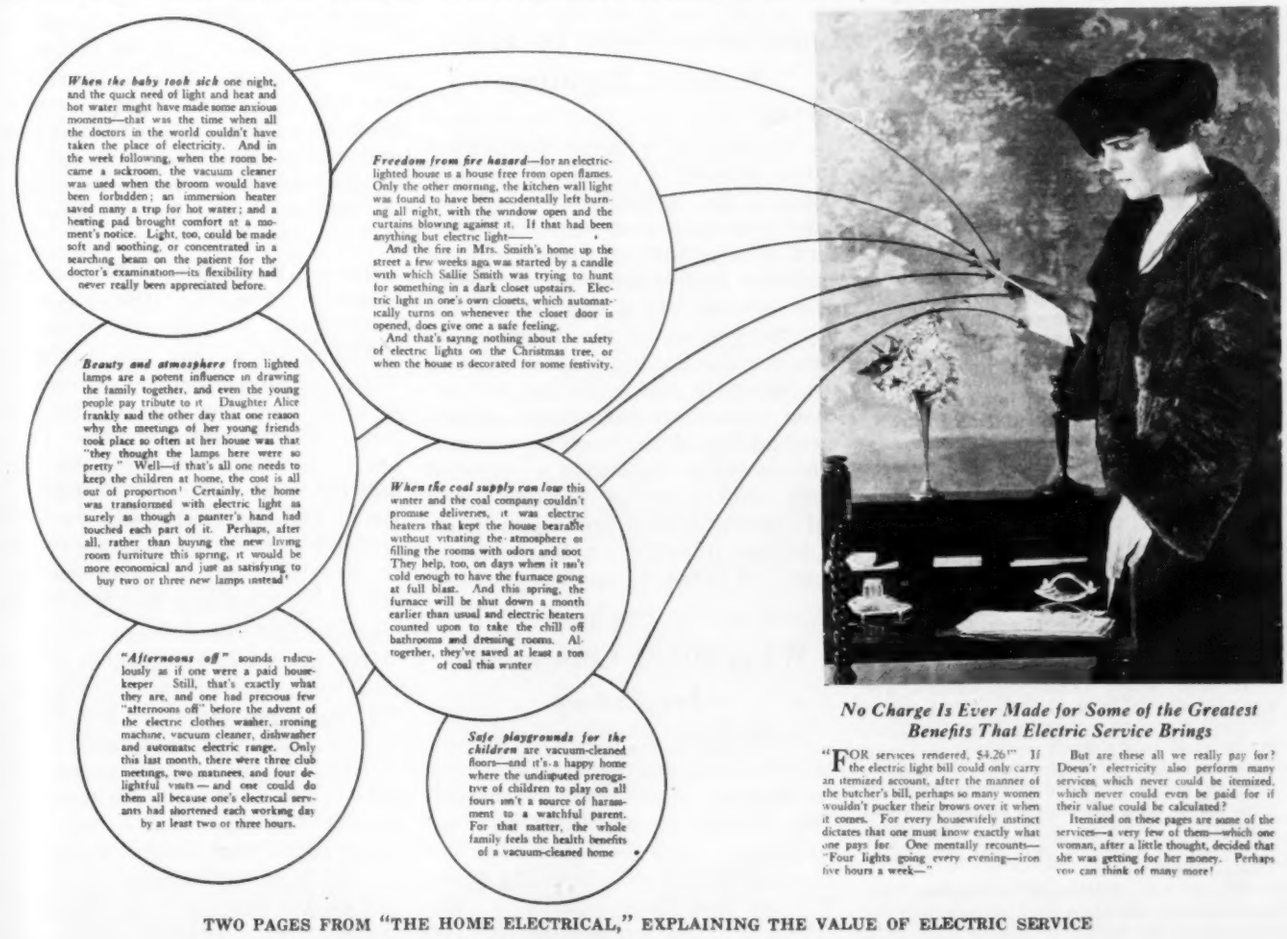
No. 53. As long as people need light Central Indiana Power Company cumulative preferred stock will pay dividends.

Central Stations Using an Electrical Pictorial for the Home

THESE two pages are reproduced from a small publication entitled *The Home Electrical*, which has recently made its appearance. It is a distinct innovation in electrical publishing, for its purpose is to carry the message of electric service into the home in behalf of the central station.

For the purpose of drawing the line sharply between ordinary advertising and this type of educational reading several utility companies who have been for several months distributing *The Home Electrical* to their consumers are sending out this little pictorial in special envelopes marked "From the office of the President, United Light & Power Company." This secures attention, and the fact that the publication bears no name but that of the publisher is impressive. It is received as, and in fact is, an interesting independent picture-folder sent as a courteous gift. Therefore in addition to its educational influence it has a distinct public relations value. Each month the articles and pictures are devoted to some seasonable theme—housewiring, Christmas gifts, labor savers, electrical convenience and so on.

These central stations are taking advantage of the fact that people are *interested* in the household uses of electricity; that there is a popular appetite for information on this subject. They believe that men and women want to know more about it, and that there is an opportunity for the electrical industry to tell them many things, both in pictures and in facts, beyond the scope of the ordinary advertisements of light and power companies, manufacturers, jobbers, contractors and dealers whose messages usually have immediate selling as their chief objective. *The Home Electrical* has been developed as a medium for telling this more general story of electricity in our daily living and is designed to be distributed by central station companies to their residence customers. It is published by *Electrical Merchandising*, New York.


Do You Think of These Unwritten Items On Your Electric Light Bill?—
When the baby took sick one night, and the quick need of light and heat and hot water might have made some anxious moments—that was the time when all the doctors in the world couldn't have taken the place of electricity. And in the week following, when the room became a sickroom, the vacuum cleaner was used when the broom would have been forbidden; an immersion heater saved many a trip for hot water; and a heating pad brought comfort at a moment's notice. Light, too, could be made soft and soothing, or concentrated in a searching beam on the patient for the doctor's examination—its flexibility had never really been appreciated before.
Freedom from fire hazard—for an electric-lighted house is a house free from open flames. Only the other morning, the kitchen wall light was found to have been accidentally left burning all night, with the window open and the curtains blowing against it. If that had been anything but electric light——
And the fire in Mrs. Smith's home up the street a few weeks ago was started by a candle with which Sallie Smith was trying to hunt for something in a dark closet upstairs. Electric light in one's own closets, which automatically turns on whenever the closet door is opened, does give one a safe feeling.
And that's saying nothing about the safety of electric lights on the Christmas tree, or when the house is decorated for some festivity.
Beauty and atmosphere from lighted lamps are a potent influence in drawing the family together, and even the young people pay tribute to it. Daughter Alice frankly said the other day that one reason why the meetings of her young friends took place so often at her house was that "they thought the lamps here were so pretty." Well—if that's all one needs to keep the children at home, the cost is all out of proportion! Certainly, the home was transformed with electric light as surely as though a painter's hand had touched each part of it. Perhaps, after all, rather than buying the new living room furniture this spring, it would be more economical and just as satisfying to buy two or three new lamps instead!
When the coal supply ran low this winter and the coal company couldn't promise deliveries, it was electric heaters that kept the house bearable without vitiating the atmosphere or filling the rooms with odors and soot. They help, too, on days when it isn't cold enough to have the furnace going at full blast. And this spring, the furnace will be shut down a month earlier than usual and electric heaters counted upon to take the chill off bathrooms and dressing rooms. Altogether, they've saved at least a ton of coal this winter
"Afternoons off" sounds ridiculously as if one were a paid housekeeper. Still, that's exactly what they are, and one had precious few "afternoons off" before the advent of the electric clothes washer, ironing machine, vacuum cleaner, dishwasher and automatic electric range. Only this last month, there were three club meetings, two matinees, and four delightful visits—and one could do them all because one's electrical servants had shortened each working day by at least two or three hours.
Safe playgrounds for the children are vacuum-cleaned floors—and it's a happy home where the undisputed prerogative of children to play on all fours isn't a source of harassment to a watchful parent. For that matter, the whole family feels the health benefits of a vacuum-cleaned home
No Charge Is Ever Made for Some of the Greatest Benefits That Electric Service Brings
"FOR services rendered, $4.26!" If the electric light bill could only carry an itemized account, after the manner of the butcher's bill, perhaps so many women wouldn't pucker their brows over it when it comes. For every housewifely instinct dictates that one must know exactly what one pays for. One mentally recounts—"Four lights going every evening—iron five hours a week—"
But are these all we really pay for? Doesn't electricity also perform many services which never could be itemized, which never could even be paid for if their value could be calculated?
Itemized on these pages are some of the services—a very few of them—which one woman, after a little thought, decided that she was getting for her money. Perhaps you can think of many more!

TWO PAGES FROM "THE HOME ELECTRICAL," EXPLAINING THE VALUE OF ELECTRIC SERVICE

Pacific Gas & Electric Increases Free Allowance on Extension

AS A RESULT of easier financing conditions, together with lower rates of interest and generally better business conditions, a new and consirerably more liberal line extension policy than the one which has been in effect was adopted by the Pacific Gas & Electric Company, effective March 1. Under the new arrangement the company will make extensions at its own expense where the cost does not exceed $125 per customer or where the cost of the extension does not exceed five times the estimated annual revenue. Under the former policy the free limit was $80 per customer, or the company would spend not in excess of three times the estimated annual revenue. Following is the complete text of the new rules:

(1) *Residential.*—The company will make extensions for bona-fide residential consumers at company expense where cost of such extension does not exceed $125 per consumer, or where the estimated annual gross revenue equals or exceeds 20 per cent of the total cost of said extension and facilities necessary to supply service.

(2) *General.*—(a) Where the estimated annual gross revenue equals or exceeds 20 per cent of the total cost of the extension and facilities necessary to supply service, the company will, at its own expense, make all extensions on public highways necessary to supply electric service to applicants (except service to mines, temporary service or service of doubtful permanency).

(b) When the estimated annual gross revenue to be secured from any electric extension is less than 20 per cent, the company will, when business is of a permanent nature, pay all costs in connection therewith up to an amount equal to five times the estimated annual revenue, and any excess of cost over said amount shall be advanced as extension deposit by the applicant, subject to refund as follows:

If the total revenue during any period of five consecutive years exceeds the cost of the said extension and facilities paid for by the company, then the company will refund to the consumer an amount equal to such excess, provided that no refunds will be made after the tenth year and that the revenue during the tenth year for the purpose of determining the refund shall not be taken as more than the average revenue of the three preceding years.

If and when other consumers are connected within a period of ten years to the extension so made, then the company will make such refunds as may be necessary to make said extension deposit equal to the difference between the total cost of the extensions and facilities involved and the combined five-year revenue of original and additional consumers.

When an additional extension, requiring an advance on the part of the consumer, is made in connection with an extension upon which advances have been made, a refund will be made to consumer making such additional extension as outlined above. When such consumer or consumers have been reimbursed to the full extent of his or their advances, then the revenue derived from such additional extension will be added to the revenue of the original applicant for the purpose of computing the original applicant's refunds.

(3) *Rice Irrigation.*—(a) Where the estimated annual gross revenue equals or exceeds 50 per cent of the total cost of the extension and facilities necessary to supply service, the company will, at its own expense, make all extensions on public highways necessary to supply electric service to applicants.

(b) When the annual gross revenue to be secured from any electric extension is less than 50 per cent of the total cost of the extension and facilities necessary to supply service, the company will pay all costs in connection therewith up to an amount equal to twice the estimated annual revenue, and any excess of cost over said amount shall be advanced by the applicant, subject to refund as follows:

If the total revenue during any period of two consecutive years exceeds the amount of the extension and facilities paid for by the company, then the company will refund to the consumer an amount equal to such excess, provided that no refunds will be made after the tenth year and that the revenue during the tenth year for the purpose of determining the refund shall not be taken as more than the average revenue for the three preceding years.

Convention Paper Increases Window Lighting

THE connected load in window lighting of a large department store served by the Fitchburg (Mass.) Gas & Electric Light Company was increased nearly 200 per cent as a result of presenting the customer with a paper on show-window lighting which was read at the last convention of the Illuminating Engineering Society. After offering the paper to the customer for perusal, the central-station sales department and the department store's window decorator conducted a series of tests which proved to the user's satisfaction that it would pay to use a higher intensity in his windows than had formerly been employed.

What Other Companies Are Doing

Washington, D. C.—The growth of residential customers in this city is showing a remarkable increase. The growth of dwelling-house installation business continues in Washington on an increasing scale. For the first three months of 1923 orders for new connections received by the Potomac Electric Company were double the volume for the same period in 1922, which was the heaviest year in the history of the company. With the addition to the steam-power plant at Benning, the company estimates it will have sufficient boiler capacity for the next three years. Despite the fact that beginning with October the company had to go into the open market for coal its records show that its per kilowatt cost of producing electricity in 1922 was lower than in any previous year. This was attributed to increased efficiency at the plant and to highly satisfactory results from West Virginia coal, which was delivered on contract until October.

California. — Dates for the display of electrical homes in California under the direction of the California Electrical Co-operative Campaign have recently been set. The four different exhibits now definitely decided upon cover a period of two months. The dates are as follows: Fresno, April 12-29; San Francisco, May 3-19; San Diego, May 17-June 3, and Sacramento, May 31-June 16.

Springfield, Mass. — Without direct solicitation of new business, the United Electric Light Company secured a net gain of 3,754 meters in 1922, compared with 2,725 in the best previous year. Natural development of business, the effect of general electrical advertising and the co-operation of contractor-dealers are believed to be major factors in this growth of service.

Beaver Dam, Wis. — Electrically operated pumps for the municipal waterworks of this city were installed about a year ago, replacing steam-driven equipment. Power is supplied from the lines of the Wisconsin Power, Light & Heat Company. A comparison shows that during the past year the amount of water pumped electrically exceeded by 2,000,000 gal. that pumped during the previous year by steam, and the cost of operation was $2,000 less than for the preceding year.

Boston, Mass.—A gain of 65 per cent in kilowatts contracted for by the sales department of the Edison Electric Illuminating Company was attained in 1922 as compared with 1921. The total new business contracted for was 79,287 kw. The added motor load totaled 45,558 hp., against 20,646 hp. in 1921. New business results last year were the largest in the history of the company.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

Progress in Steam Research.—As a result of a program sponsored by the A. S. M. E., three organizations have been carrying on researches to gather further information regarding the properties of steam. The Harvard Engineering School is investigating the Joule-Thomson cooling effect in superheated steam at pressures up to 600 lb. and at temperatures up to 600 deg. F. The Massachusetts Institute of Technology has been determining the pressure-temperature-volume relation of superheated steam at high pressures and over as wide a range of superheats as possible. The United States Bureau of Standards has been determining the specific heat of water for a more accurate determination of the mechanical equivalent of the mean heat unit. Reports and comments of progress are reviewed in this article.—*Mechanical Engineering*, March, 1923.

Combustion Control for Steam Boilers.—C. H. SMOOT.—The author has presented a clear picture of what happens when burning coal on a grate and the reasons for the difference in the thickness of the fuel bed required when burning different kinds of coal. —*Power*, March 6, 1923.

Leicester Central Generating Station. —L. C. KEMP.—A twenty-page article describing and illustrating the construction and arrangement of equipment in the central station being built at Leicester, England. The initial installation is for 10,000 kw. with provisions for an ultimate extension to a total capacity of 60,000 kw. to 100,000 kw. The author describes the buildings and foundations, the coal and ash handling plant, boiler house and engine room, switchgear and transformers.—*English Electric Journal*, Vol. 2, No. 3.

Generation, Control, Switching and Protection

Compression Chambers on Automatic Oil Circuit Breakers. — O. L'EPLATTENIER.—The author regards the following as the essential facts for calculating compression chambers on oil circuit breakers of high interrupting capacity: The rupture of the arc must completely take place in the inside of the compression chamber, therefore it must be made big enough to allow room for the contacts when open. The chamber must be perfectly insulated, fireproof and able to stand high pressures. Studying the general equation of an arc and the gases evolved by the action of the arc on the oil during and after the opening of the contacts, the author explains how to determine with accuracy the conditions of maximum efficiency under which chambers of compression or explosion are to be built.—*Elettrotecnica*, Feb. 25, 1923.

Parallel Operation of Direct-Current Generators. — SCOTT HANCOCK.—There are three considerations of fundamental importance in paralleling compound generators: (1) They must have drooping voltage characteristics. Compound machines usually have rising characteristics at their terminals, and it is this consideration which requires the use of an equalizer. (2) They must have the same voltage at no load and at some other point, usually full load. This characteristic—obtained by shunting one or more series fields—seems to be generally understood. (3) The resistances of the series field circuits from the equalizer to the busbar must be inversely proportional to the current rating. This is the consideration which is usually neglected and hence causes most of the trouble. These general considerations, including the special case of generators too far apart to use an equalizer, as in railway substations, are analyzed in detail by the author.—*Electric Journal*, March, 1923.

Rating of Cables for Intermittent or Fluctuating Loads.—S. W. MELSOM and H. C. BOOTH.—The extent to which the rating of a cable is affected by an intermittent or fluctuating load as compared with continuous running conditions is investigated theoretically, and formulas are given by means of which the effect of any type of loading can be calculated. It is shown by experimental determinations on various sizes and types of cables that the thermal time constant can be calculated either from a heating or cooling curve of a particular cable or from the specific heat and mass of the various components of the cable. Tables are given showing the rating for the cables for which load tables are given in the I. E. E. Wiring Rules, on the same basis as for motors, i.e. half-hour and hour ratings.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

Transmission, Substations and Distribution

Wooden Poles of Very Long Life.—A. VAUPEL.—A German firm produces a wooden pole for which a useful life of thirty-three years is claimed. The pole consists of a tar-oil-impregnated hardwood lower part to which is clamped, about a yard above the ground, a "kyanized" soft-wood pole. Three or four very heavy and rust-proofed steel clamps, each a yard long, connect the two pole pieces. A large number of small bolts instead of a few heavy ones are used in the clamps to avoid any splitting of the wood. A pole of this construction is claimed to be absolutely safe against breakage. If stressed beyond its elastic limit the pole will bend rather than break. The results of a number of comparative stability tests of ordinary poles and the new poles are given, showing decided mechanical superiority for the latter. A cost comparison between plain "kyanized" poles of sixteen and one-half years' average life and the new poles of thirty-three years' life gives a saving of more than 34 per cent in favor of the new poles.—*Elektrotechnische Zeitschrift*, March 1, 1923.

Inductance on Transmission Lines.—A. DE MARCHI.—The author presents a chart for determining the inductance on transmission lines. Inductance, length of conductors, distance between conductors and their radius are given independently, so that no calculations are required. This chart is simple, clear and easily constructed.—*Elettrotecnica*, March 5, 1923.

Units, Measurements and Instruments

Radial Voltage Coil in Induction Meters.—E. EVANS.—To obtain an exact 90-deg. phase displacement between the current and the voltage coil in induction meters for alternating current many very ingenious but more or less complicated methods have been used and are still in use where the iron core of the voltage coil is in a tangential position with regard to the running disk. The author shows in this paper that practically all of these difficulties may be successfully overcome by swinging the voltage magnet 90 deg. around so that it will stand radially against the disk. Such a meter, with the current magnet under the disk and its two poles tangential with the disk, was first introduced by the Bergmann concern and was later adopted by several other European manufacturers. By proper dimensioning of iron and copper a torque of 5 gram.-cm. and more may be reached easily.—*Elektrotechnische Zeitschrift*, Feb. 22, 1923.

Electron-Tube Tuning-Fork Drive.—E. A. ECKHARDT, J. C. KARCHER and M. KEISER.—Several methods for maintaining tuning-fork vibrations electrically without circuit interruptions by means of electron-tube circuits have been in use. In this paper the authors describe apparatus and circuit arrangements which have been found advantageous. To date the electron-tube drive has been applied to a large number of forks with frequency range from 50 cycles to 2,000 cycles.—*Journal of the Optical Society of America and Review of Scientific Instruments*, Vol. VI, No. 9.

Obtaining an Indication of Transformer Temperatures.—J. B. GIBBS.—Measurements by thermometers placed in oil, the difference in temperature between the oil and the windings and the use of heating coils for determining

the winding temperature are the subjects discussed in this article.—*Power*, March 6, 1923.

Motors and Control

The Textile Industry.—The Feb. 23 issue of the *Electrician* is given over almost entirely to the progress made in textile-mill drive. Among the more important articles are: "Electrical Operation and Control of Textile Machinery and Processes" by Frank Nasmith, "The Conversion of Spinning and Weaving Mills from Steam to Electric Drive" by V. Mallalieu, "The War and the Textile Industry," "A Description of an All-Electric Textile Mill," "Electricity and Its Effect on Textile Industry," "Group Drive in a Lancashire Mill" and "Textile Drives" and "Motor Design."—*Electrician*, Feb. 23, 1923.

Application of Electricity to the Sugar Industry.—The sugar industry within the past few years has been highly electrified. Steam turbines are used for power generation in some cases. In these cases non-condensing turbines are used, the low-pressure steam being used in the process work. In several of the recent refinery installations direct current has been used throughout. This enables the very accurate control of crushers and rolls. —*Electrical News*, March 1, 1923.

Industrial-Plant Repair Shop.—E. J. FORD.—A systematic schedule of inspection to detect motor and control trouble as soon as it develops and a well-equipped repair shop for handling the unavoidable breakdowns mean low operating costs and minimum loss of production through failure of power service. In this article details are given of the methods employed and the facilities available for the maintenance of electrical equipment in the twenty-nine departments of the Kewanee (Ill.) plant of the Walworth Manufacturing Company. Although ninety of the 238 motors are exposed to dust and steam and acid fumes, the care which they receive is so effective that not more than fifteen motors are rewound a year.—*Industrial Engineer*, March, 1923.

Starting Direct-Current Motors. — C. A. ARMSTRONG.—Two types of series-lockout contactors that are used on automatic motor starters are described and the operation of two controllers using these types of contactors is given in detail.—*Power*, March 13, 1923.

Heat Application and Material Handling

Graphite Welding Electrodes.—S. L. WALWORTH.—The use of graphite electrodes for welding and cutting where the carbon arc was formerly employed is becoming increasingly popular. Owing to the slower vaporization of graphite by the arc much less carbon is carried into the weld when graphite electrodes are used. This produces a softer weld than is possible with amorphous carbon electrodes and one that more nearly approaches the composition and hardness of the parent metal. The accompanying table shows how the increased electrical conductivity allows much lighter current densities to be carried by the graphite electrodes without excessive heating. —*Journal of the American Welding Society*, March, 1923.

HIGH-CURRENT DENSITIES ALLOWABLE WITH GRAPHITE ELECTRODES

Size Graphite Welding Electrode, In.	Current per Electrode, Amp.	Curent Density, Amp. per Sq. In
¼	130 to 250	2,650 to 5,000
⅜	185 to 270	1,870 to 2,700
½	260 to 440	1,320 to 2,200
⅝	340 to 560	1,100 to 1,800
¾	410 to 660	930 to 1,500
⅞	500 to 850	830 to 1,400
1	600 to 1,000	760 to 1,250

Electrochemistry, Electrophysics and Batteries

Manufacture of Chemicals by Electrolysis.—A. CLARKE.—The main types of cells used in the electrolysis of alkali chlorides are the fused electrolyte cell, the porous diaphragm cell, the bell cell and the mercury cell. High degree of purity, high efficiency, absence of complicated side reactions, etc., are the advantages claimed for electro-organic chemical manufacture. The author deals with the use of electro-organic methods for the elimination of the catalyzers, such as the expensive arc oxides of the heavy metals for oxidation and reduction. A description is given of the more important commercial cells that are on the market for the production of alkali chlorides by electrolysis.—*Beama*, March, 1923.

Telegraphy, Telephony, Radio and Signals

Power-Circuit Interference with Telephone and Telegraph Lines. — S. G. BARTHOLOMEW.—The author points out that the very sensitive apparatus necessary to transmit and safely reproduce telegraphic signals or spoken words is easily deranged by extraneous influences. The losses due to leakage from power circuits cannot be afforded and the liability to these is considerable, especially when the lines are in proximity to traction circuits having an earth return. The effects of induction are still more serious, consisting principally of disturbing noises, which are sometimes so violent as to produce what is termed acoustic shock to an operator. Methods of eliminating these effects, the reduction of harmonics, transformer conditions and the resulting cost of interference are discussed.—*Electrician*, March 2, 1923.

Stationary Waves on Open-Ended Solenoids.—A. PRESS.—The problem of the coupling coil has received new importance physically because of its application to wireless signaling. The nodal-point distribution on an elongated Tesla coil was recently investigated and it was found that the nodal distances fell off in value as the ends of the coil were approached. This attenuation of distance had been attributed to end effects, but it is shown by the author that the cause is rather a body effect.—*Journal of Institution of (British) Electrical Engineers*, March, 1923.

Signal Maintenance on an Oregon Railway.—H. J. CHARTERS.—The signaling equipment on the lines of the Portland Railway, Light & Power Company at Porland, Ore., consists of ninety-one United States type "G-1" non-car-counting block signals, 142 automatic signals for protecting spring switch points, fourteen terminal signals for stub-end city car lines, seven train order boards, four crossing bells and two special light signals for indicating operation over bridges. Excellent results are being obtained by systematic inspection and repair work which cover all the devices of a warning character used to protect patrons and expedite operation.—*Electric Railway Journal*, March 17, 1923.

Traction

Diesel-Electric Rail Motor Car.—Following the experiments with a direct-driven Diesel locomotive on the Prussian State Railways in 1913, orders were placed for five self-propelled rail cars to be driven by Diesel engines coupled to electric generators with electric motors geared to the driving axles. As the war interfered, the locomotives that had been built were taken back and new engines installed. A general description of the locomotives, including the engines, generators, motors and electrical equipment and control, is given. Brief operating results are described.—*Railway Electrical Engineer*, March, 1923.

Equipment and Operation of Railway Workshops. — G. A. GUTHRIE — The author gives a description of the steel foundry in the South African railway workshops at Pretoria. He points out how the equipment and operation of these shops increased the efficiency of the company. — *Journal of the South African Institution of Engineers*, February, 1923.

Miscellaneous

Vectorial Addition of Complex Quantities. — VLADIMIR KARAPETOFF. — A kinematic device is described which permits the performance, graphically and without computations, of the following operations on complex quantities: Additions, obtaining of reciprocals and conversion from the polar into the orthogonal form, or vice versa. The device makes it possible to solve in a simple manner alternating-current problems involving impedances in series and in parallel. An illustration is given of the predetermination of the performance characteristics of an induction motor in accordance with the exact theory of this machine. It can also be used for the predetermination of performance characteristics of transformers, transmission lines, etc. The name that the author has given to the device is "CPS'er," after C. P. Steinmetz.—*Sibley Journal of Engineering*, March, 1923.

Scientific and Industrial Research

A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work

Conducted by PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N. Y.*

[PRINTED IN THE THIRD ISSUE OF EACH MONTH]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Fuses for Potential Transformers, Wire Resistors for

Tests have been made on wire resistances of about 60 ohms in series with 13,200-volt cartridge fuses for potential transformers. Such resistors limit the violence of a dead short-circuit on the high-tension side of the transformer and prevent the fuse from being blown to pieces or torn from its clips. Moreover, without such resistors the recovery voltage after a short circuit shows a very prominent high-frequency over-potential, while with the resistors the recovery is almost normal. The ratio error due to such resistors is negligible. Carborundum rods of about 200 ohms resistance broke under sustained short circuit and their use is not recommended.—*A. F. Bang, Pennsylvania Water & Power Company, Baltimore, Md.*

Instruments, Graphic, for Recording Troubles

In co-operation with the engineers of one of the largest power companies in this country, recording instruments have been developed which operate at a low chart speed ordinarily, but in which the speed rises up to sixty times normal feed whenever a disturbance occurs. An electromagnet is controlled by an overload relay in the power circuit, so that the instant the current rises to an abnormal value, the wattmeter, the voltmeter, the ammeter and the power-factor meter begin to record at the increased chart speed.—*J. W. Esterline, Indianapolis, Ind.*

Oscillograph Timer for Transient Phenomena

An attachment has been developed which permits the repetition of transient electrical phenomena a desired number of times per second, say ten. In this manner a steady image of the repeated phenomenon can be observed on the oscillograph screen. Then it can be recorded photographically on the film, if so desired. Thus it is possible to observe or to adjust a periodic transient phenomenon before actually photographing it. The device consists of a drum with suitable contacts, driven by a synchronous motor. The same arrangement can be also used with an indicating ammeter or voltmeter, thus making it possible to read directly the effective value of current or voltage of a repeated transient.—*H. M. Turner, Yale University, New Haven.* [This extension of the oscillograph field should prove to be of considerable interest in the study of transient phenomena, especially where they can be repeated at a rate sufficient to give a continuous impression.—EDITOR.]

Paints for Concrete and Metal Surfaces

A series of tests on concrete paints has been completed during the year. Exposure panels of concrete were painted with samples of paints submitted by manufacturers, placed on the roof of the laboratory and examined periodically. It was found that very few of these paints were giving satisfactory protection at the end of the first six months. Those which were satisfactory at the end of six months are still satisfactory after a year and a half. A similar series of tests is now under way for paints on structural steel, and a series has just been started on paints for galvanized metallic surfaces.—*Hydro-Electric Power Commission of Ontario, Toronto.*

Poles of "Centrifugated" Reinforced Concrete

Constructed by winding around a long, slightly coned temporary wooden core a spiral of iron, upon which is disposed the light steel skeleton around which again is wound a double steel spiral. After removal of the wooden core the skeleton is put into a divided wooden mold, which is then filled to about one-third with the concrete mixture. The mold is contained in a cage of angle irons and steel disks, which rotates at first at 600, rising to 1,000 r.p.m. for about ten minutes in a special machine. By centrifugal action the concrete mixture distributes itself into a cylindrical mass throughout the steel skeleton. In an actual test a 10.35-m. pole, rated for 350 kg. stress at top, broke with 2,000 kg. after deflecting 1.1 m.—*C. Zorzi (from Elettrotecnica).*

Power Plants, Remote Control of

There are cases where it is desirable to open and close switches and to determine conditions of operation of a power plant or substation from a distance. This is now possible by means of remote supervisory control of a number of stations along a single pair of telephone lines, utilizing the principles of the automatic telephone. A load dispatcher, located at the most convenient point, may in this way supervise and control the operation of a considerable group of stations, starting and stopping generators, closing or opening circuit breakers and obtaining other desired indication by either audible or visual signals. The same pair of telephone lines can be used for conversations.—*J. L. McCoy, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.* [This is an arrangement intermediate between the full automatic and the manual control of power machinery. Incidentally, this is a new and useful application of the automatic telephone principle, probably not foreseen by the original inventors.—EDITOR.]

Thermostatic Relay Switch

In order to use a low-voltage source of power in the thermostat itself and a 110-volt or 220-volt source in the solenoid of the main switch which controls the temperature, a selective relay has been devised on a new principle. The arrangement is suitable for automatic oil burners, electric refrigerating machinery, electric heating units and similar equipment where it is necessary to operate an electric switch in accordance with temperature changes. — *Minneapolis Heat Regulator Company, Minneapolis, Minn.*

In Progress or Purposed

Cables, Power, Tests with High-Tension Direct Current

Before the use of direct current for this purpose can be considered successful the proper ratio between direct-current volts and alternating-current volts, to obtain the same results, should be definitely known. Foreign investigations indicate that this ratio should be about 2.5, but the American manufacturers up to the present writing have not been willing to agree to a ratio higher than 1.5. If the ratio of 2.5 is correct, then a test made with the direct-current voltage limited by a ratio of 1.5 will be entirely without value, as it is not enough above the normal operating voltage to give results that are at all comparable with those heretofore obtained with alternating current. Two of the cable-manufacturing companies have undertaken to make tests of this character, and results should be available very shortly.—*A. I. E. E. Committee on Transmission and Distribution.*

Cables, Soil Temperature Measurement for

To determine the basic temperature for the calculation of the current-carrying capacity of underground cables, soil temperatures are being taken 18, 27 and 36 in. below an asphalt-covered street in Washington, D. C. These measurements have been made every three hours since July 1, 1922, and will be continued until July 1, 1923, in order that they may embrace all seasonal changes.—*A. Smirnoff, Potomac Electric Power Company, Washington, D. C.*

Circuit Breakers, Non-Oil-Throwing

These breakers are provided with explosion chambers and with separating chambers. The operating mechanism is underneath the cover of the breaker. When the breaker is opened under load the arc is interrupted in the lower part of the oil tank. The gas that is generated passes upward, mixed with some oil, through the center hole in the lower baffle, and the gas and oil are partially separate while passing through the upper baffles. They are finally carried to the separating chamber, where complete separation of the gas and oil and cooling of the gas take place. The oil then returns to the tank.—*General Electric Company, Schenectady, N. Y.*

Lightning Arresters, Classification of

A classification of lightning arresters is being planned which will make a more complete comparison of the available types possible and will give operating engineers a better basis for choosing proper arresters for different lines. For the main subdivisions of such a classification see the *A. I. E. E. Journal*, November, 1922, Vol. 41, page 897.—*A. I. E. E. Sub-Committee on Lightning Arresters.*

Transformer Temperature

It is proposed to make a study during the coming year of transformer temperature and possible allowance of overload, together with the duration of such overload for urban and rural service.—*Overhead Systems Committee of Great Lakes Division, N. E. L. A.*

Suggestions for Research

Cables, Determination of Faults in

There is apparently a demand among the central stations for an accurate and ready means of determining the character and extent of faults in cables, and after the fault has been determined by measurement, there is need of some apparatus, preferably portable, which will localize the fault.—*F. V. Magalhaes, New York City.*

Heat Transmission

The division of engineering, with the co-operation of the division of physical sciences, is organizing a committee and developing a program for an investigation in heat transmission. Important fundamental and industrial problems exist in heating and ventilating of dwellings and workplaces, refrigeration, steam engineering, metallurgy, chemical processes, expansion and contraction of structures. At present there is need for information on the heat conductivity of many materials.—*National Research Council, Washington, D. C.*

Photo-Electric Cells

Photo-electric cells are beginning to be used in some practical applications in place of the human eye, for example in photometry, in sorting objects according to their shade of color, in closing contacts, etc. The present cells are rather delicate and do not possess the required constancy of characteristics. It is desired to develop them into a practical piece of apparatus suitable for use in places where they do not get the same expert care as they would in a physical laboratory.

Transmission Lines, No-Load Losses in

It would be of interest to operating engineers to know whether the no-load losses in a transmission line consist only of the I^2R and corona loss, or whether there may not also be inductive earth losses of a magnitude that should not be neglected, since they probably increase at least with the square of the voltage. These losses would also occur with the line loaded, but might not be easily measured.—*R. J. C. Wood, Los Angeles, Cal.*

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

News from the Capital

Reports on Susquehanna Projects and Other Matters Gleaned from Official Sources

A PLAN to install 360,000 hp.—an installation greater than that on the American side at Niagara Falls—on the Susquehanna River is revealed by an application which has been filed with the Federal Power Commission by the Susquehanna Power Company of New York. The proposed development is to be at Conowingo, Md. It is the intention to construct a dam 100 ft. high, which will create slack water for 25 miles to McCall's Ferry at Holtwood, Pa. The Susquehanna Power Company already has acquired nearly all the flowage rights needed for the project and has made extended engineering studies. Further investigation, however, is planned. It is understood that Philadelphia interests are behind the undertaking. In proposing the installation of equipment sufficient to generate 360,000 hp. the company has in mind furnishing large blocks of power for use in Philadelphia and Baltimore.

It also is reported that the Pennsylvania Water & Power Company has in mind the development of the power immediately above its Holtwood plant. Such a plan would develop slack water in the Susquehanna from tidewater to the vicinity of Harrisburg and would pave the way for the utilization of these pools by a navigation project.

Alabama Power's Growing Load

The Alabama Power Company has applied to the Federal Power Commission for a license covering the installation of a 5,000-hp. unit in Government Dam No. 17, on the Black Warrior River. Right to install a similar unit at Dam No. 16 will be asked in the near future. The growth of the Alabama Power Company's load has been so marked in recent months that these small developments are being seized upon in an effort to keep abreast with the demand for power. The company on April 7 put into service the first unit at its development at Duncan's Riffle on the Coosa River. Two additional units of that plant are to be installed with all possible expedition. In addition the company is pressing its investigations on the Tallapoosa River in the hope of developing at the earliest possible time the large power resources of that stream.

Since Congress has been unwilling to appropriate funds for the employment of an adequate personnel to attempt the determination of fair values covering actual investments on the part of licensees in water-power projects, a suggestion has been made that the investment in such works can be verified by inserting a provision in each license requiring the licensee to pay for the service of an inspector to check up items entering into the capital investment. This plan would provide funds in an indirect way for carrying out that part of the work. The proposal has not, however, been officially brought to the attention of the Federal Power Commission, and it is not known how that body would look upon such an expedient.

Colorado Discussion Postponed

Discussion of the Colorado River situation by the Federal Power Commission, which was to have taken place on April 18, was advanced until April 19.

Highest Court Finds Against New York Commission

The United States District Court for Southern New York had full authority to grant an injunction to the New York Telephone Company against the Public Service Commission to enjoin temporary exchange rates ordered last year by the commission, and the temporary rates were too low to bring a reasonable return on the value of the company's property. This is the main purport of a decision of the United States Supreme Court rendered April 16. The court finds that under the New York commission law the telephone company was not obliged to ask the commission for a rehearing and then appeal to the state courts before taking the case to the federal tribunal, but had a right to immediate appeal on the ground that the temporary rates prescribed were confiscatory.

The New York Public Service Commission started an investigation of telephone rates on March 3, 1922, and before it was completed issued orders reducing rates temporarily, pending final determination, one schedule of maximum rates being fixed for New York City and other schedules for the remainder of the state. The company obtained an injunction in the district court, and the commission appealed to the United States Supreme Court. After the argument the commission fixed new and permanent rates, which, according to the company, will grant a higher return than the temporary rates would have done. These are left undisturbed.

Deadlock Likely at Albany

Small Prospect of Agreement Between Senate and House on Public Utility Legislation

THE legislative session at Albany, N. Y., is drawing to a close with the Senate and Assembly at loggerheads over the passage of the public utility legislation introduced by the Democrats. While the Republican Assembly is willing to afford some measure of home rule to New York City in the matter of regulation of its transit facilities and to amend the Public Service Commission law by taking away the right of the commission to increase a fare, rate or charge regardless of the existence of a franchise agreement, contract or special or general law to the contrary, it will not adopt the radical measures proposed by the Democratic administration.

A bill introduced into the House by Assemblyman Jesse of New York, which is likely to pass that chamber, leaves the personnel and manner of appointment of the commission unchanged, but deprives it of the power to fix temporary rates while they await final determination or to increase rates over those specified in contracts, though it is permitted to lower them at will.

Governor Smith's water-power bill calling for state development and ownership passed the Senate on Tuesday by a vote of twenty-seven to twenty-two.

Water-Power Situation in Pennsylvania

Uncertainty as to the water-power legislation which the Pennsylvania Legislature may adopt is delaying proposed developments in that state. Since Governor Pinchot brought forward his water-power bill not a single charter has been granted at Harrisburg covering a power project. It is the Governor's idea to bring intrastate water-power development under virtually the same restrictions as are imposed by the federal water-power act on the development of power on navigable waterways.

Nebraska May Acquire Hydro-Electric Sites

A resolution has been introduced into the Legislature of Nebraska at the instance of Governor Bryan which provides for a general vote in November, 1924, upon an amendment to the state constitution permitting the state to "establish, maintain, acquire, convert and develop hydro-electric and other power

sites and plants, sand, cement, limestone beds for building material and other natural resources beneficial to the state." The resolution was sent to a committee by the House of Representatives on April 10.

The Nebraska House earlier in the session passed a resolution asking Henry Ford to survey the power sites of the state with the view of engaging in their development.

Big Susquehanna Plant

Metropolitan Power Company Organized to Build Station with Ultimate Rating of 200,000 Kw.

THE Metropolitan Power Company is being incorporated under the laws of Pennsylvania to build and operate a large steam-electric power generating plant at Middletown, Pa., on the Susquehanna River. The initial capacity of the plant will be 30,000 kw., but it will be designed for extension to an ultimate capacity of 200,000 kw. The entire power generated in the plant will be sold to the Metropolitan Edison Company, which will then be in a strong position to meet the demand for electric power and lighting service in the extensive industrial district of Reading, Lebanon and sections in the vicinity of Middletown and Steelton. The Metropolitan Edison Company will be enabled to use this steam power in conjunction with the full capacity of the present hydro-electric power station of the York Haven Water & Power Company, which it controls.

Provision was made so that prior to the company being incorporated a well-adapted site could be acquired for the plant and borings for the foundations started. A contract for a 30,000-kw. turbine-generator, together with boilers and accessories, has already been made, and delivery will be during the early part of 1924. In the meanwhile the buildings, condensing facilities, coal storage, railway terminals, etc., will be completed, ready for the machinery, so that the station should be in operation not later than the middle of 1924.

The plant of the Metropolitan Power Company will be connected by 110,000-volt tower transmission lines with the present large generating plant of the Metropolitan Edison Company at Reading, which is now being connected by 110,000-volt tower transmission lines with the system of the Pennsylvania Edison Company, supplying the territory in Easton and adjacent territory. A large generating station at Holland now being erected by the New Jersey Power Corporation will be connected in to the Reading-Easton transmission line as well as to the system of the New Jersey Power & Light Company, which supplies territory in New Jersey from a point within 30 miles of New York City to the Delaware River and as far north as the New York State line. These transmission lines will form a system to which 90,000 kw. of new capacity will be connected in the near future.

New Central Station for "Tri-Cities"

The erection of a new central station on the Mississippi to serve the "Tri-Cities" (Davenport, Iowa, and Rock Island and Moline, Ill.) and surrounding territory is now being planned by the United Light & Railways Company, Grand Rapids, Mich. The site has not yet been selected, but a 20,000-kw. turbine-generator has been ordered by the Moline-Rock Island Manufacturing Company, which supplies power to the other subsidiaries of the United Light & Railways Company in that territory. Delivery of the unit is to be made in March of next year. Powdered fuel may be used. The total cost of the projected station is put at $1,750,000.

The new turbine unit will be designed to operate on 350 lb. steam pressure, 250 deg. superheat and 29 in. vacuum referred to a 30-in. barometer. The generator will be designed for 20,000 kw., 80 per cent power factor, and will be wound for 13,200 volts, three-phase, 60 cycles. It will be equipped with a direct-connected exciter wound for 250 volts.

Charleston, S. C., Seeks Development of Santee Power

An effort is on foot, backed by strong local public sentiment, looking to the development of a 37,500-hp. project in the vicinity of Charleston, S. C. The Columbia Railway & Navigation Company proposes to construct a canal from the Santee River at a point near Ferguson to the Cooper River at a point near Monck's Corner. In that way a head of 55 ft. can be developed. The project also involves the use for storage purposes of 20,000 acres of land which is not being used otherwise. It will provide a navigation channel direct from Charleston to Columbia via the Congaree River. Such a canal existed in the past. The feasibility of the project depends on the amount of water which the federal government will authorize the applicant to divert from the Santee River.

St. Maurice Company Orders Propeller-Type Turbines

A contract for four propeller-type turbines of 30,000 hp. each for the new hydro-electric plant of the St. Maurice Power Company on the St. Maurice River, Quebec, has just been placed with the Dominion Engineering Works, Canadian licensees of the I. P. Morris Department of the William Cramp & Sons Ship & Engine Building Company of Philadelphia. These turbines, when completed, will be the highest-powered propeller-type turbines in the world, exceeding in unit capacity those built recently by the same firm for the Manitoba Power Company at Winnipeg. They will operate under a head of 60 ft. at 130 r.p.m. The Westinghouse Electric & Manufacturing Company is to furnish the electrical equipment.

The St. Maurice River Power Company is a subsidiary of the Shawinigan Water & Power Company, which already has two large developments on the river. The new station is at Gres Falls, 10 miles below the Shawinigan Falls station and about 20 miles below the Laurentide plant. When it is completed its rating of 120,000 hp. will raise the total amount of hydro-electricity developed on the St. Maurice to more than 500,000 hp.

Thomson Visits General Electric Laboratories

BEFORE returning to England, Sir Joseph J. Thomson, the master of Trinity College, Cambridge University, who has world-wide fame as an electrophysicist, visited the General Electric Company's laboratories at Schenectady, N. Y. He is here shown with Dr. Irving Langmuir, assistant director of the laboratories; Dr. R. B. Owens, secretary of the Franklin Institute; W. C. L. Eglin, vice-president of the Franklin Institute, and Dr. W. D. Coolidge, inventor of the Coolidge X-ray tube. He is seen examining a 20-kw. radio tube.

Electric Steel Researchers Hold Convention

The Electric Steel Founders' Research Group held a convention at East Aurora, N. Y., on April 13 and 14, at which twenty-six representatives of the five electric steel casting plants forming the group joined in a discussion of important steel-foundry problems. W. H. Worrilow, president of the Lebanon Steel Foundry, Lebanon, Pa., presided. Papers on "Electric Steel Castings for Specialties," by W. J. Nugent, Chicago, and "Properties of Electric Steel Castings and Where They Should Be Used," by T. S. Quinn, Lebanon, were read. W. J. Corbett spoke on new uses for electric steel castings, explaining that some users of metal parts have not yet realized that steel castings having thin sections can be made by the electric process with considerable reduction in weight and economy in machining and assembling the castings.

Last Chance to Take Course in Industrial Heating

In order that central-station sales engineers may have a final opportunity to take one of the industrial electric heating courses which were so successfully given last year under the auspices of the National Electric Light Association, arrangements have been made for one more course in 1923, under the supervision of the industrial electric heating division of the association. V. M. F. Tallman, of Charles H. Tenney & Company, Boston, Mass., who is vice-chairman of the Power Sales Bureau of the association, is in charge of enrollment.

The course will be held May 14 to 26 inclusive, the General Electric and the Westinghouse company giving parallel instruction during this period. The General Electric course will start at Schenectady, N. Y., and be completed at Pittsfield, Mass., and the Westinghouse course will begin at Mansfield, Ohio, include Pittsburgh, Pa., and be completed at Newark, N. J.

P. G. & E. to Increase Water Storage at Bear River

The contemplated increase of the storage at Lake Fordyce on the South Yuba-Bear River development and improvements in the Drum power system have been announced by the Pacific Gas & Electric Company. The present 90-ft. dam at Lake Fordyce will be raised 47 ft., increasing the storage from 20,000 acre-ft. to 47,000 acre-ft. Two seasons will be required for this work.

Improvement work on the canal carrying the water to the Drum power house will be undertaken soon. The alignment will be rectified in places, detours of construction eliminated and leakage corrected. A second penstock is to be laid down the 1,375-ft. drop to the Drum power house in order that full load may be carried on the generators, making Drum the "peaking" plant of the system. An afterbay will be built in Bear River gorge half a mile below Drum in order to utilize the water from the plant's "peaking" operations.

Operation the Keynote

Pittsburgh Convention of Institute Will Be Devoted Mainly to This Phase

THE program of the meeting of the American Institute of Electrical Engineers to be held in Pittsburgh on April 24-26 (see ELECTRICAL WORLD for March 31, page 767) shows that the local section through its convention committee has well sustained the reputation of Pittsburgh for unostentatious accomplishment. The large attendance that is expected will be rewarded by the operating papers filled with definite data and practical conclusions that are to be presented on subjects of vital interest to the electrical industry.

The midwinter convention in New York presented the accomplishments of the electrical specialists. At Pittsburgh the operating specialists will be heard. Experiences with reactors, relays, grounded systems, surges, Peterson coils, arcing grounds, lightning disturbances and insulators on systems like those of the Public Service Electric Company, the Philadelphia Electric Company, the Alabama Power Company and the Duquesne Light Company will be described for the benefit of the industry. Another notable paper will be presented showing the performance of a good oil-burning locomotive in a series of tests on the Southern Pacific system. These tests are of a character to give real opportunity for accurate analyses of railroad electrification projects.

No convention of electrical engineers could well be held in Pittsburgh without papers on electric furnaces, and at the coming convention splendid papers will be presented on this subject by men who know it from the operating standpoint.

There is a place for discussion of every electrical engineering accomplishment in the Institute, and the Pittsburgh meeting appears to be particularly well suited to the operating group connected with central stations and industrial establishments. In addition to the convention itself, the Pittsburgh district, of course, contains actual engineering installations and developments that will afford instructive and interesting material to the delegates and visitors.

Del Monte A. I. E. E. Convention Postponed

The date for the Pacific Coast convention of the American Institute of Electrical Engineers, to be held at Del Monte, Cal., heretofore announced as Sept. 25-28, has been changed to one week later, and the meeting will therefore be held from Oct. 2 to Oct. 5.

State Ownership Failure in Europe, Says Barnes

Julius H. Barnes, president of the Chamber of Commerce of the United States, who recently returned from an extended trip in Europe, told his observations on the economic condition there at a dinner given in New York on Monday night. After telling of the return by the Italian government of the parcel-post system and the telephone to private hands and discussing general politico-commercial conditions in Europe, which he found improving in many countries, Mr. Barnes said:

"The outstanding fact which impressed us in all these countries in Europe is the very clear conviction that state ownership and state operation of public facilities—I won't say public utilities, but public facilities—has distinctly written itself as a failure. Not only is this shown in Italy's effort to get all its public state-owned facilities in private hands, but it is shown in Austria, where there is a recasting of the government railroad service and a discharge of 100,000 superfluous employees. It is shown in Great Britain, where the railroads under their return to private operation have greatly quickened the business and economic life of that island and greatly improved the service and at the same time reduced the rates. There is a general appreciation throughout all of Europe that these facilities must not only be in private hands but they must be regulated so wisely that they will present a field of attraction for the superior grade of private ability to enlist itself in their administration, and it is true that where this has been tried, as in Great Britain, they are meeting with satisfactory results."

Anomalous Utility Situation in Menominee

A discontinuance of electric light and power service, as well as of electric railway operation and gas supply, may be the outcome of the situation in Menominee, Mich., which has been supplied with electrical energy for two years by the Menominee & Marinette Light & Traction Company without this company possessing a franchise or having authorization from the Public Service Commission. When its electric light and power franchise expired in March, 1921, the company continued to furnish electricity. Lately its two other utility franchises expired, and the Aldermen have prepared new contracts which the company thinks unfair. A threat to make the latter remove its wires from the streets and alleys of the city has been made.

Objectionable features contained in the terms of the new franchise, as enumerated by J. P. Pulliam, vice-president and general manager of the Menominee & Marinette Light & Traction Company, include the requirement that the company shall put its hydro-electric plants outside the city limits under municipal control, including future im-

provements and additions; the clauses providing that no increase in rates agreed on with the city shall be binding for more than a year unless indorsed by a three-fifths popular vote, and that the City Council by a majority vote may rescind such increased rates after three years; the provision giving the city mandatory power to order extensions; the stipulation giving the city street commissioner authority to withhold approval of expenditures for equipment, extensions, salaries, etc., and the right given the city to dictate the compensation of directors and officers.

Mr. Pulliam, in making known the company's stand, announced that it stood ready to expend approximately a million dollars in Menominee in the next two years for improvements in its various utility properties.

Functions of Trade Associations

Vote Taken by Nearly Seventeen Hundred Bodies Composing United States Chamber of Commerce Reveals General Agreement on What These Should Be

APPROVAL of properly functioning trade associations for each important branch of industry and commerce in the country was voted by business organizations affiliated with the Chamber of Commerce of the United States in a preliminary referendum canvass held on April 13 last, results of which have just been announced by the national chamber. Eight separate propositions relative to the activities of trade associations were submitted, and the affirmative prevailed by very large majorities in every case, negative votes ranging from 5 to 282 in a total poll of nearly 1,700.

The propositions that carried are as follows:

"First—Because of numerous useful and important functions of obvious propriety trade associations should exist for each important branch of industry and commerce.

"Second—A trade association should have such a membership that it can be representative of the industry in connection with problems affecting the general advance of the industry.

"Third—A trade association should be prepared to consider all problems affecting the general advance of its industry or branch of commerce.

"Fourth—Trade associations should continue free from special forms of governmental control.

"Fifth—Statistics of capacity, production, stocks and sales should be collected by a trade association for its industry or branch of commerce.

"Sixth—Statistics of actual prices in closed transactions should be collected by a trade association for its industry or branch of commerce.

"Seventh—Any interpretation of statistics or other comment which could induce or facilitate concerted action on the part of members should be omitted by a trade association.

"Eighth—Statistics of capacity, production, stocks, sales and prices a trade association should make as available to the public and to government agencies interested in following the course of the industry and commerce as to members."

The largest negative vote was cast against the eighth proposition.

The propositions were taken from the report of the special committee created by action of the board of directors of the Chamber of Commerce of the United States in 1922 to "make a general survey of trade associations and consider activities of trade associations which are in the interest of the public and of the fields of enterprise which are represented." Philip H. Gadsden of Philadelphia, vice-president of the United Gas Improvement Company, headed the committee as chairman.

The committee expressed itself as of the opinion "that, while a minority of trade associations may have engaged in practices which have laid them open to complaint under the law with respect to restraints of trade, the vast majority have proved their great value for the advancement, day by day, of the processes of production and distribution."

VIEWS OF COMMITTEE

In expressing opposition to government control of trade associations, the committee said: "The possibility that a trade association may err by violating a statute no more justifies any attempt on the part of governmental authority to control trade associations in all their activities than the possibility of illegal acts on the part of individuals warrants like supervision over all their actions. Such supervision would inevitably restrict the freedom of action of trade associations in meeting the problems which they exist to solve."

The committee laid down as its recommendations three rules with relation to the statistical activities of trade associations, as follows: "(1) Reports of members to their association should be accurate and sufficiently complete to prevent misconstruction. (2) As distributed to the membership, the statistics should not be accompanied with any interpretation or other comment which could induce or facilitate concerted action on the part of members. (3) All statistics regarding prices should be confined to closed transactions and should not refer to pending transactions or future transactions."

Summarizing its conclusions, the committee said: "The committee believes that trustworthy information concerning capacity, production, stocks, sales and prices is essential to the effective operation of industry and trade under competitive conditions. The voluntary reporting of such information to trade associations and the subsequent publication and dissemination of such information in a manner which makes it available not only to contributors but also to consumers and to the public generally is beneficial alike to the field of business and the public and does not constitute a restraint of trade."

Gift of £100,000 for Research in England

The gift of £100,000 to the Royal Society of Great Britain by Sir Alfred Yarrow, a prominent shipbuilder, is announced. The object of the donation is the same as that pursued in America by Ambrose Swazey, who gave $500,000 to make possible the organization of the Engineering Foundation—the "furtherance of research in science and engineering" and the "advancement in any other manner of the profession of engineering and the good of mankind."

"I have for many years," Sir Alfred Yarrow said in announcing his gift, "held the view that the prosperity of England has been greatly hampered in the past for the want of better promotion of scientific investigation and its application to practical affairs. I am convinced that the future prosperity of England will be largely dependent upon the encouragement of original scientific research. The birth of new industries and the development of existing ones are due largely to the growth of science, thus insuring employment and advancing the welfare of the whole community. It is doubtful whether even yet it has been realized how completely this country would have been at the mercy of our antagonists in the late war had it not been for the research work done by our scientific men before the war and during its course."

America May Participate in World Power Conference

American technical and business associations have been invited to take part in the World Power Conference to be held in London, England, next year. Preliminary conferences have already been had in New York on the question of American participation, and the matter has been brought formally to the attention of all the national organizations in this country that are interested in the question of power. An organization meeting at which definite action will be taken is tentatively scheduled to be held in the Engineering Societies Building in New York on June 13. At that time a draft of a suggested organization will be presented. O. C. Merrill, executive secretary of the Federal Power Commission, has acted as chairman of the preliminary conferences, and J. W. Lieb of the New York Edison Company is chairman of the sub-committee on suggested organization.

The purpose of the World Power Conference, as expressed a year ago by its British promoters, is "to consider how the industrial and scientific sources of power may be adjusted nationally and internationally."

Talk of New Niagara Pact

Treaty with Canada Permitting Diversion of 80,000 Second-Feet Finds Favor

RAPIDLY increasing need for more diversion from the Niagara River for the use of the Queenston plant of the Ontario Hydro-Electric Commission is expected to result in stimulating Canada's interest in a new treaty. Two years ago, when the State Department suggested the advisability of discussing the matter of additional diversion, Canadian officials did not encourage the proposal. Since then, however, the situation has changed materially. The load furnished to customers on the American side has increased very materially. On the Canadian side there has been steady expansion of the distribution system until it reaches as far westward as Windsor, opposite Detroit. The demand has reached a point where additional diversion is absolutely essential to the most efficient operation of the plants of the Hydro-Electric Commission.

It can be stated most emphatically that no official on either side will consider any diversion which will detract from the scenic value of the Falls. A total diversion of 80,000 second-feet, proposed as the amount to be agreed upon in a new treaty, would, in the opinion of engineers, have no bearing on this.

The demand for additional diversion is even greater on the American side than in Canada. The Niagara Falls Power Company has been running at full capacity for eight months. By the time that the 100,000 hp. of additional power which is the net gain represented by the improvements under way is available next fall it will be absorbed immediately.

The hope is expressed in Washington that the new treaty can be confined to the power phase of the situation, leaving other matters, such as the diversion at Chicago, to be handled separately. No controversy is anticipated over the diversions for power purposes, but the other questions are likely to result in extended discussion.

Arkansas Company to Push Caddo River Project

The Caddo River Power & Irrigation Company has, it is announced, been merged with the Arkansas Light & Power Company, which will undertake the hydro-electric power development on the Ouachita River near Hot Springs and Malvern for which financing and engineering plans have been completed. The Arkansas company already has constructed a 66,000-volt line from its Pine Bluff-North Little Rock-Malvern-Arkadelphia system to within a few miles of the sites for the first dam and power stations.

Permits covering three sites on the Ouachita have been obtained from the federal and state commissions, engineers estimating that a total of 120,000 hp. will be developed. The first dam and generating station will develop 15,000 hp. and will cost between $1,500,000 and $2,000,000. It has not been definitely determined whether the first dam will be constructed at what is known as the Remmel site, a few miles north of Malvern, or at the Hot Springs site, about 10 miles south of Hot Springs. Surveys and tests for foundations show that either site will be satisfactory. The development will create large lakes and will go far to prevent floods on the Ouachita River. The three dams and generating stations will entail an ultimate investment estimated at $15,000,000.

It is planned to have the first station in operation within fifteen months. Through the existing transmission line of the Arkansas Light & Power Company, the hydro-electric energy will be made available to Pine Bluff and twenty-two other cities and towns immediately upon completion of the water-power station, and but little construction is necessary to connect up all the lines of the company and make the power available to the numerous cities and towns served by this company.

Commercial Questions Are Up at St. Louis

Second Day's Sessions of Middle West Division, N. E. L. A., Cover Appliance Load, Highway Lighting, Electrical Homes, Rural Service, Interconnection and Other Topics

AN ENTHUSIASTIC discussion of the commercial side of the central-station industry marked the Thursday morning session of the convention of the Middle West Geographic Division of the National Electric Light Association, held at St. Louis last week, the opening sessions of which were reported in last week's ELECTRICAL WORLD.

NEW BUSINESS CHANCES

E. W. Lloyd spoke interestingly on the work of the Joint Committee for Business Development. He believed enough appliances could be sold to make the yearly residential revenue from this source alone equal that from residential lighting consumption. One of the difficulties in the sale of appliances, he indicated, was that too many central-station men are not convinced of their value and therefore are not in position to sell them successfully. He called attention to the possibilities of highway lighting as a means of protecting life and property as well as facilitating travel. Pointing to the lack of man power that is forcing industry to develop new methods of accomplishing tasks, he declared that here lies an opportunity for the central station in the development of new business. He spoke also of heat treating and melting of metals electrically, expressing the opinion that in a generation all melting of non-ferrous metals will be done electrically.

Electricity on the farm, railway electrification and other commercial possibilities were cited, Mr. Lloyd contending that the individual member companies of the N. E. L. A. are not giving enough time to the consideration of the commercial problems involved in all these uses of electrical energy. He made a plea that each company detail at least one man to devote time to the development of the commercial work of the association and asked that more and better men be constantly added to the committees of the Commercial Section.

F. S. Dewey of Kansas City told of the experience of the Kansas City Power & Light Company with its electrical home exhibit. Between 37,000 and 40,000 people passed through the home in four weeks. A force was organized to take the visitors through and explain all the features of lighting and domestic uses of electricity so that the service offered would be thoroughly impressed on them. Results of this work, he said, are constantly developing. Co-operation between the various branches of the electrical industry in Kansas City had shown that the misunderstandings and mutual criticisms that so often arise could readily be avoided.

He criticised the policy of employing salesmen who will not take the chance of losing business by telling the customer frankly when the results desired cannot be accomplished. Honesty in telling the customer exactly what can be done and expected, Mr. Dewey said, is one of the most important elements in the sale of electric appliances and devices.

N. T. Wilcox made a plea for more money to carry on the commercial work of the N. E. L. A.; J. L. Harvey of Wichita suggested highway lighting as one of the elements through which rural electric service can be developed, and O. H. Simonds of Dubuque, Iowa, asked for greater support of the national association.

BANQUET SPEECHES

At the banquet on Wednesday night President Frank W. Smith of the national association told of the arrangements for the coming convention in New York, asking the delegates to make special efforts to attend. Vice-president Davidson and Executive Manager Aylesworth also spoke, the latter expressing belief in merchandising by the central-station company and also the opinion that those central stations that have got out of the merchandising phase of the business will go back into it.

Martin J. Insull at the Thursday afternoon session dwelt upon the public's interest in public utilities and told the delegates that unfavorable public

opinion is largely due to the fact that the public is misinformed as to the affairs of the utilities.

RURAL SERVICE PROBLEM WORLDWIDE

J. C. Martin, Western editor of the ELECTRICAL WORLD, discussed the rural electric service problem, saying that it is not purely an American or central-station problem but is a worldwide agricultural economic problem owing to the need of the farmer to improve his living conditions and lower his production costs by supplanting hand labor with machine work as has been done in other industries. The work of the newly organized committee of electrical and agricultural interests to study the problem was described. Austin Burt of Waterloo, Iowa, said that confidence between the central-station companies and the farmers is the foundation on which the solution of the problem must be based and that central-station men must seek to establish that confidence.

Steps were taken by the committee having in hand the survey of the interconnection problem in the Middle West Division states to co-ordinate its work with that of a similar committee in the Great Lakes Division. Some of the interconnections that may seem logical in the future are more or less divided between the territory of the two sections because of the location of the systems.

The officers of the division elected for the coming year are: President, L. O. Ripley, Kansas Gas & Electric Company; vice-presidents, H. C. Roberts, Union Power & Light Company, Omaha; H. C. Blackwell, Kansas City Power & Light Company, and B. J. Denman, Tri-City Railway & Light Company. Horace M. Davis of Lincoln, Neb., is the secretary-treasurer.

Report of Cities Service Indicates Marked Progress

The pamphlet report of the Cities Service Company for 1922, which has just been issued, shows an increase in net earnings from $12,944,716 to $14,205,674. Preferred dividends of the company were earned 2.41 times against 2.23, and the earnings on the average amount of common stock outstanding during the year amounted to $14.88 a share, as compared with $13.04 a share in the preceding year. Gross earnings of the Cities Service Company in 1922 were $14,658,971, as compared with $13,461,770 in 1921.

The earnings of the public utility properties increased 20.65 per cent over the preceding year, or from $6,918,741 to $8,347,546. This was not only sufficient to pay all Cities Service Company interest charges and the preferred dividends, but showed a comfortable return on the outstanding common stock.

General business conditions, according to the report, have improved in almost every territory where Cities Service public utilities are operated. The demand for power and light is constantly increasing, and the company is doing what it can to increase its capacity to meet this demand. Extensive construction programs are in progress in Ohio, Colorado, Joplin and Sedalia, Mo., and Texas.

New York City Has Novel Electric Sign

An electric sign of novel and artistic type has been erected along the canyon of white lights on Broadway, New York, to announce a popular motion-picture entitled "The Covered Wagon." The wagon and entire upper portion of the sign are lighted by ten 500-watt floodlamps, and on the front of the wagon is a lantern which is an exact facsimile of the type used in 1849. A lighting effect which simulates water running under the wagon is obtained by six stereopticons automatically operated by motors which turn a color

ELECTRICAL DEVICES CAUSE THE WATER ON THIS SIGN TO FLOW

wheel with water painted on it. Each lamp is a 2,000-watt nitrogen-filled unit specially made for stereopticon purposes. In the center of the water is a small sign in raised bronze letters reading "Paramount Pictures." These letters are set in a box flush with the water and are illuminated by indirect lighting which causes the letters to stand out as if they were set in the water.

The sign was constructed and installed by the Norden Company, under the supervision of Mortimer Norden, the company's engineer.

Earnings of Northern States Power Increase

The annual report for 1922 of the Northern States Power Company indicates that the gross earnings ($13,881,919) increased 7.09 per cent and the net earnings ($5,781,092) 11.01 per cent as compared with 1921. After payment of the fixed charges and the regular dividend on the preferred stock a balance of $1,628,126 was available for amortization, depreciation, common dividends and surplus. The report further considered the development of an additional hydro-electric plant on the St. Croix River and the new steam plant now under construction in St. Paul, which will have an ultimate capacity of 200,000 hp. During the year the company gained 4,494 stockholders and added forty-five additional communities to its transmission lines.

Power Problems Will Occupy New England Division

Papers on power problems by leading engineers will characterize the annual meeting and Technical Section day of the New England Division, N. E. L. A., at the Hotel Biltmore, Providence, Friday, April 27, beginning at 10:30 a.m. Officers of the division will be elected for the coming year, in accordance with a recent constitutional amendment, and the following technical papers, with discussions, will be presented: "Pulverized Fuel," by R. E. Dillon, Boston; "Use of Three-Phase Versus Single-Phase Transformers for Power Loads," by W. P. Schwabe, Thompsonville, Conn.; "Power-Factor Correction," by F. L. Hunt, Greenfield, Mass., and "Development in Power Production," by Oscar Junggren, General Electric Company, Schenectady, N. Y. After the meeting it is expected that delegates and guests will have an opportunity to visit the new service station of the Narragansett Electric Lighting Company at Melrose.

Electrical Men Represented in Arbitration Society

The Arbitration Society of America, which, under the presidency of Emerson McMillin, is endeavoring to become a "people's tribunal" to which disputants may submit any form of controversy for immediate determination by arbitrators selected by themselves or, at their option, appointed by the society, has as chairman of the electrical industry J. A. Hawks of the Monroe Lamp & Equipment Corporation, New York City, who calls attention to the possibilities, under the arbitration law now in force in the State of New York, of substituting arbitration for litigation. The purposes of the society, which numbers among its indorsers E. Donald Tolles, Charles L. Eidlitz and Arthur Williams, are briefly stated to be:

First—To conduct a campaign of education in promotion of the general cause of arbitration in all disputes and differences.

Second—To organize, equip and operate in New York City, and later in the larger cities throughout the country, tribunals of arbitration for the speedy, inexpensive and just determination of controversies and misunderstandings.

Third—To have enacted a uniform arbitration law in all the states of the Union and to encourage the insertion of an arbitration clause in all trade and industrial contracts.

General Electric Sales Managers Hold Conference

A three-day conference of sales managers of the General Electric distributing jobbers was held this week, beginning Monday, at the Bridgeport factory of the company for the discussion of timely problems in merchandising and trades policies. J. O. Wetherby was conference manager.

Brief News Notes

Montreal Company May Build New Plant at Cedars Rapids.—The Montreal Light, Heat & Power Company, Ltd., shows in its report for the year ended Dec. 31, 1922, earnings of 8.15 per cent on common stock as compared with 6.54 per cent in 1921. An additional unit at Cedars Rapids is planned to provide a further 40,000 hp.

"Farthest North" Radio.—The Canadian government, it is announced, is planning a chain of six radio stations extending into the Arctic Circle. Five of the stations will be in the Northwest Territories and another at Dawson. The stations on or near the Mackenzie River will be at Fort Smith, Fort Resolution, Fort Simpson, Fort Norman and Fort McPherson.

United Light & Railways Company Makes Record.—For the first time in its history the United Light & Railways Company of Grand Rapids, Mich., has crossed the twelve-million-dollar mark in its gross earnings for a twelve months' period, showing $12,029,187 for the twelve months ended Feb. 28, compared with $11,235,196 in 1922.

Danville Has New Turbine.—A new 7,500-kva. turbine was placed on the lines of the Danville (Ill.) Street Railway & Light Company on April 4. This 2,300-volt, 1,800-r.p.m. unit doubles the present station capacity. Additions are also being made to the substation which will bring its capacity up to 6,000 kw.

Michigan Electric Light Association Helps Meter School.—Co-operating with the Michigan Electric Light Association, the electrical engineering department of the University of Michigan gave a short intensive course for electric metermen from April 9 to April 14. All work was done in the electrical laboratories of the university, and the course was directed by members of its department of electrical engineering.

Southern Canada Power Plans New Plant.—It is announced that the Southern Canada Power Company has determined to construct a hydro-electric station of 30,000 hp. at Hemmings Falls, near Drummondville, Quebec, on the St. Francis River. This is to meet demands in the eastern townships of the province and to carry out existing contracts. The report of this company for the year ended Sept. 30 showed a constant growth.

Iowa Meter Course Successful.—The short course for electric metermen at Iowa State College, March 12 to 16, closed with the largest attendance in the five years of its history. The total attendance was 130, representing forty-nine counties and forty-eight power companies, and sixteen manufacturing companies were represented. The students were classified in four groups covering beginners, men of some experience, fully experienced men, and meter superintendents, local managers and others.

Southern California Edison Earns 9.78 per Cent.—The Southern California Edison Company reports for the year 1922 a balance available for common-stock dividends of $3,731,855, equivalent to a return of 9.78 per cent a share on the company's outstanding stock. This compares with $2,532,532, or 9.02 per cent, in the year 1921. On Dec. 31 the profit and loss surplus stood at $2,786,890, against $1,244,777 on Dec. 31, 1921. At the end of the last current year the current assets of the company were $10,768,827 and current liabilities $9,343,867, leaving a working capital of $1,424,960.

University of Colorado Meter School.—Among the many universities and colleges which have held or will hold short courses for electric workmen this spring is the University of Colorado, which held classes from March 19 to March 24 with the co-operation of manufacturers and public service companies. Lectures were given by experts and plants were visited. A heavy storm, blocking the railroads, interfered to some extent with the attendance, but so much interest was manifested notwithstanding that the university is planning to repeat the course next year.

Shawinigan Company Shows Growth.—The annual report of the Shawinigan Water & Power Company for 1922 gave its gross earnings at $4,629,641, an increase of $405,596 over 1921 and of $686,282 over 1920. Net earnings amounted to $1,597,283, an increase of $6,471 over 1922 and a decrease of $11,759 as compared with 1920. The company's assets grew by $1,200,000 as compared with the previous year. The Laurentide Power Company, which is associated with the Shawinigan, had profits of $670,806, a gain of about $100,000 over 1921 and of about $238,000 over 1920.

Standard Gas & Electric Earnings.—Complete figures of combined earnings of the operated public utility properties of the Standard Gas & Electric Company for the twelve months ended Jan. 31, 1923, show that net earnings for the period increased 13.79 per cent as compared with net earnings for the previous twelve months. This was accomplished on an increase of 7.47 per cent in gross earnings. The combined earnings of all the properties for the same period compare as follows:

	Gross	Net
1923	$37,703,978	$14,154,573
1922	35,082,274	12,438,685
Increase	$2,621,703	$1,715,888

Farmington River Company Plans Two New Hydro-Electric Developments.—Construction will soon begin upon two new hydro-electric plants on the Farmington River, near New Boston, Conn., for the Farmington River Hydro-Electric Corporation, recently organized under the laws of Delaware to develop energy in this section of Connecticut. One development will include three dams, reservoirs and a 4,000-hp. plant to operate under a head of 300 ft., and the other a dam, pipe line and station of 3,600 hp., operating under 150-ft. head. New Hartford and vicinity will be served.

Interconnection in Iowa.—The last link in the interconnection of all the properties of the Iowa Railway & Light Company, the Iowa Electric Company and the Iowa Falls Electric Company will, it is reported, be completed this season, when a high-tension transmission line between Nevada and Boone will be built. The line will be approximately 28 miles in length and will have steel towers and aluminum conductors. When it is completed it will tie Nevada in with the Cedar Rapids, Marshalltown, Boone, Perry, Grundy Center and Iowa Falls power plants and provide a complete circuit over the state.

Sponsors for Standardization Appointed.—Sponsorship for radio standardization has been assigned by the American Engineering Standards Committee to the Institute of Radio Engineers and the American Institute of Electrical Engineers jointly. This action was taken in accordance with the recommendations of the large representative conference called by the Bureau of Standards. Sponsorship for the standardization of engineering and scientific abbreviations and symbols has been assigned to the American Association for the Advancement of Science, the National Research Council, the Society for the Promotion of Engineering Education and the United States Bureau of Standards jointly.

New Water-Power Stations in Italy.—The first units installed in the power station in the Val Formazzo, on the southern slope of the Simplon, in Italy, have been put in operation. This station derives its power from the Tannino, a mountain stream, and mountain lakes afford reservoirs with a combined capacity of 15,000,000 cu.m. Power is transmitted over a 74-mile, 60,000-volt line to a transformer station at Novara. Another company has just put in operation a new central station at Temu, on the Lake of Avio. Storage capacity of the reservoirs which will supply the plant will be 18,000,000 cu.m. This station is built for five units of 11,000 hp. each, of which two have been installed. Energy is transmitted at 125,000 volts to San Polo d'Enza, whence it will be sent to the central stations of central Italy.

Iowa Goes Down with Radio-Controlling Devices Still Intact.—When on March 22, in Panama Bay, the old battleship Iowa was sunk by modern superdreadnaughts under the eyes of Secretary of the Navy Denby there went down the first full-sized radio-controlled ship. The Iowa had been previously stripped of all equipment except her boilers and engines, and there were on board only the ingenious radio-controlling devices which were operated from storage batteries. The large mass of batteries was kept charged by a Kerr turbine, which had been purchased by the Navy Department in 1912. Elec-

tricity has been rapidly coming to the fore in the operation and control of equipment on board warships, and the possibilities in the directing and controlling of a battleship from a distance entirely by radio have been shown to be great.

Portland (Ore.) Company to Spend $5,000,000.—Announcement was made at the annual meeting of the stockholders of the Portland (Ore.) Railway, Light & Power Company that $5,000,000 would be spent this year on the company's construction program. Construction expenditures during 1922 amounted to $3,525,832. The greatest single item of expense this year will be the construction of the first unit of the Oak Grove hydro-electric project, which will bring in to the city of Portland 25,000 kw. of electrical energy. No changes were made in the board of directors or the officers of the company. Reports submitted showed that the company has 3,700 stockholders, more than 3,000 of whom reside in the state. Net earnings during 1922 showed an increase of $252,340, or nearly 7 per cent over the net earnings for 1921. After deducting interest, operating expenses, taxes and other expenses from the 1922 gross earnings there was a surplus left of $955,364.

European Radio Development.—William Dubilier, president of the Dubilier Condenser & Radio Corporation, who has just returned from Europe, announces that some very interesting radio developments have taken place there, among which is a radio-control system for trains, developed by the Germans. It is installed on locomotives and gives a signal to the engineer which, it is thought, will help to avert collisions. A new means has been devised for generating high-frequency oscillations which, Mr. Dubilier says, is much cheaper and easier to build and maintain than tubes for high power and can be used for power up to 25,000 kw. He reports also developments in the direction of splitting oils making insulation or obtaining nitrogen from the air to permit commercial currents to be used in a city. Many large radio plants are now contemplated, one of which is to be installed in Egypt, and condensers are being designed for these installations which are almost as large as a dwelling house and which will cost about $100,000 apiece.

Sioux City Company Links Up Twenty-two Towns.—Electrical energy for the supply of twenty-two northwest Iowa towns was made available recently when new transmission lines of the Sioux City Gas & Electric Company went into service. This marks the first step in the expansion of the company's field, which will include approximately seventy-five towns in the vicinity of Sioux City. The towns served by the lines already opened are Le Mars, Merrill, Remsen, Marcus, Cleghorn, Meriden, Kingsley, Washta, Quimby, Alton, Granville, Sheldon, Boyden, Sanborn, Primghar, Archer, Orange City, Sioux Center, Pock Valley, Hull, Doon and Alvord. The furnishing of electricity to these towns by the Sioux City Gas & Electric Company closes three local stations, two at Le Mars and one at Sheldon, according to an announcement made by William J. Bertke, general manager of the company.

Maine Water Power Commission Fails of Continuance.—By refusing to sign a bill providing for the appointment of a Water Power Commission of five members, of whom one would be appointed by the Governor for one year, two by the Speaker of the House for two years and three by the President of the Senate for three years, Governor Baxter of Maine, whose obstructive water-power policy was referred to in these columns last week (page 883), has cut off the continuance of the present commission's activities, leaving the state without an organization for the express study of water-power resources and development. The bill was left in the hands of the Governor at the close of the biennial legislative session. The present commission has been at work on conservation problems since its organization in August, 1919, and has published much valuable material on these resources of the state. Opposition encountered by the Governor in many quarters to his views in favor of state development of water powers is believed to lie behind his action. In a statement issued by him the Governor said that the best features of the commission's work would be continued under arrangements not yet made public.

Associations and Societies

Contractors to Discuss Technical Subjects.—At a recent meeting of the Elcetrical Contractors' and Dealers' Association of San Francisco, it was decided to devote a part of the time at the weekly luncheons of the association to discussion of technical electrical subjects by qualified members for the profit of the entire membership.

American Association of Operating Engineers.—The regular biennial meeting of the American Association of Operating Engineers will be held with the Central Georgia Power Company at Macon, Ga., on April 26 to April 28 inclusive. Besides business and discussions there will be visits to substations and cotton mills and a trip to Jackson Dam, on the Ocmulgee River.

Cleveland Men Charter Car for Pittsburgh A. I. E. E. Convention.—Interest even greater than usual in the spring convention of the Institute to be held at Pittsburgh next week is indicated by the fact that the Cleveland Section is arranging to charter a car to carry its delegates to the rival city. A descriptive booklet is to be prepared by the Pittsburgh Section, with contributions from the Westinghouse, West Penn, and Duquesne Light companies and the Carnegie Institute.

Public Hearing of Power Test Codes at Montreal.—During the spring meeting of the American Society of Mechanical Engineers at Montreal, May 28-31, a public hearing on the "Code on Instruments and Apparatus," chapters 1 and 2, dealing with general considerations and with the accuracy of measuring instruments and the test code for internal-combustion engines, will be held. Papers on hydro-electric development in Canada, material handling, fuel and other subjects will be read.

New England Rural Lines Committee Enlarged.—Increasing interest in the problem of rural lines extension has led to the enlargement of the rural lines committee of the New England Division, N. E. L. A., from a one-man to a seven-man basis. The chairman is H. M. Parsons, Central Massachusetts Electric Company, Palmer, Mass., and the other members are G. S. Williams, Augusta, Me.; J. Brodie Smith, Manchester, N. H.; F. L. Lovett, Montpelier, Vt.; R. W. Mitchell, Agawam, Mass.; P. F. Hodgkins, Pawtucket, R. I., and D. Loree, Willimantic, Conn.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for American Institute of Electrical Engineers latest list.]

—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Oct. 2-5. F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society — New York, April 24-27.

American Association of Operating Engineers—Macon, Ga., April 26-28. H. C. Bristol, Alaco, Tenn.

American Electrochemical Society — New York, May 3-5. Colin G. Fink, Columbia University, New York.

Nebraska Section, N. E. L. A.—Omaha, May 10-11. Horace M. Davis, secretary-treasurer.

Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Empire State Gas and Electric Association, Electric Section—Utica, N. Y., May 17-18. C. H. B. Chapin, Grand Central Terminal, New York.

Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.

Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.

American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.

National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.

California State Association of Electrical Contractors and Dealers—Dorner Lake, Cal., June 9-16.

Electric Power Club — Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.

North Central Division, N. E. L. A.—Minneapolis, June 13-15. H. E. Young, Minneapolis General Electric Company.

Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Society for the Promotion of Engineering Education—Ithaca, N. Y., June 20-22. Dean F. L. Bishop, University of Pittsburgh.

Canadian Electrical Association — Montreal, June 20-23. Louis Kon, 65 McGill College Ave., Montreal.

American Society for Testing Materials—Atlantic City, June 25-29.

Associated Manufacturers of Electrical Supplies—New London, Conn., June 26-29.

National Council Lighting Fixture Manufacturers—Hot Springs, Va., June 26-28.

Northwest Electric Light and Power Association—Seattle, June 27-30. G. E. Quinan 204 Electric Bldg., Seattle.

Ohio Electric Light Association — Cedar Point, July 10-13. D. L. Gaskill, Greenville.

Recent Court Decisions

Nonsuit Wrongly Entered Where Young Child Was Injured Through Trespass.—In Costanza vs. Pittsburgh Coal Company it was shown that defendant maintained in a lot where children were accustomed to play an electric transformer with connecting lines carrying 6,600 volts. This instrument was within an inclosure, 6 ft. x 8 ft., two sides of which were formed by a shed, the other two sides by wire netting 5 ft. high, with large meshes at the top. A six-year-old child gained access to the inclosure either over the fence or from the shed through a window and was severely injured by contact with the electricity. The trial court entered a nonsuit on the ground of trespass, but the Supreme Court of Pennsylvania has held that this order was improperly made, because of the extreme youth of the child, and has ordered a retrial to establish the negligence or otherwise of the company. (119 At. 820.)*

Can One Company Sue Another to Prevent Invasion of Territory?—An action brought by the Fulton Light, Heat & Power Company against the Seneca River Power Company to prevent the latter from selling energy in the city of Fulton, N. Y., hinged on the power of one public utility to sue another one for violation of a clause in the Public Service Commission law which forbids an electrical corporation to begin the construction of a plant or the exercise of franchise rights without first obtaining the permission of the state commission. The defendant company maintained that if the plaintiff had any grievance its legal remedy lay not in the courts but in action by the commission. In overthrowing this contention and continuing an injunction against the Seneca River Power Company, the New York Supreme Court based its decision on the fact that while the commission could take action on its own initiative in such a case, the law provided no means by which the aggrieved company could set commission proceedings in motion. (197 N. Y. S. 319.)

Arkansas Railroad Commission Without Jurisdiction Over Electric Service Companies.—The Railroad Commission of Arkansas having granted a certificate of convenience and necessity to the De Queen Light & Power Company to sell and distribute electricity in De Queen, the receiver of the Commonwealth Public Service Company, operating in the same city under an "indeterminate permit" issued by the defunct Corporation Commission of Alaska, brought suit in the circuit court and won judgment invalidating the commission's action. The Supreme Court of Arkansas, being appealed to (De Queen Light & Power Company vs. Curtis), has sustained the lower court, holding that the act empowering the Corporation Commission to grant public service corporations a certificate of convenience and necessity having been repealed by an act conferring jurisdiction on municipalities to regulate public service corporations operating within their limits and specifying the public service corporations over which the jurisdiction of the Railroad Commission, substituted for the Corporation Commission, shall extend, the Railroad Commission cannot grant such a certificate to a company distributing electricity in a city under franchise from it. (248 S. W. 5.)

Common-Law Water Right Not "Franchise."—In Southern Nebraska Power Company vs. Taylor the defendant appealed from a decision of the Nebraska State Railway Commission fixing the value of a water right held by the company against which it wished to issue stock. The company contended that the valuation as made was too low. The Supreme Court of Nebraska, declaring that in direct appeals to it from orders of the commission the orders will be reversed only where it affirmatively appears from the record that they are clearly wrong, sustained the commission. In answer to a contention made by the Attorney-General of the state that the water right was in the nature of a franchise and could not be capitalized, the court said that where a public utility corporation has succeeded to the common-law water-power right of a riparian owner and makes application to the commission for authority to issue stock against it, the statute prohibiting stock based upon franchise value does not apply. (192 N. W. 317.)

Rights of Existing Companies Cannot Be Taken Away to Avoid Competition.—An order of the Pennsylvania Public Service Commission prohibiting the Harmony Electric Company from supplying service in the borough of Ellwood City because the Pennsylvania Power Company had also charter rights in that borough led the first-named company to appeal to the courts against the commission. The Supreme Court of Pennsylvania has found that the law does not contemplate that a certificate of public convenience need be obtained by a company which was doing business within the territory covered by its charter at the time the public service company law became effective for each step taken in the advancement of its service within its unabandoned territory; that it is not necessary for an electric service company to obtain the consent of a borough before rendering service within the borough where no streets are to be occupied in rendering such service, and that the commission cannot, either directly or indirectly, take away from an electric service company which was in existence before the public service company act became effective any of its chartered powers which it had not forfeited, even though the exercise of such powers created a competitive situation which the commission desired to prevent. (119 At. 712.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Existing Utilities Desiring to Extend Service Are Not in Position of New Utilities Seeking to Enter Competitive Field.—In granting to the Terre Haute, Indianapolis & Eastern Traction Company permission to operate as a general electric utility within the city of Indianapolis, the Indiana Public Service Commission, alluding to the footing gained in the city by the company through its supply of energy for railway operation and to certain manufacturers, said: "That being true, the situation is different from that of a proposed new utility desiring to begin organizing and investing capital for the purpose of entering this competitive field, because it had its capital invested and was rendering service some six years before the Public Service Commission act was enacted. As a light and power public utility and to that extent it is entitled to the same protection afforded by the scheme of regulation upon the same basis and for the same reasons as the other utilities operating within the field. . . . The law does not authorize existing utilities to prevent extensions to plants and service on the part of other existing utilities. If it were so, there could be no improvement of utilities if they restrained each other."

Non-Operative Properties — Going-Concern Value—Power for Irrigation.—In arriving at a valuation of the Idaho Power Company's property, the Idaho Public Utilities Commission held that property not now required for use in service and representing expenditures by predecessor companies, partly under the stress of competition, should be excluded from the rate base when the time at which service demands would justify the additional expenditure necessary to complete the property is uncertain. The going-concern value in the way of property development and business development of the company resulting from the reorganization of several precedent companies was determined by a consideration of the benefits resulting to the public, the difficulties of reorganization, service conditions and results achieved. Irrigation customers, the commission held, should not be charged with all of the investment represented in the generating and transmission parts of the system used for their service only a part of the year when that investment is not active all of the year around, nor should the carrying costs of the excess be charged to other customers; but the excess capacity in the system during the off irrigation months should be considered as not yet fully energized.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

Dr. Hyde Resigns

Dr. Edward P. Hyde, who organized the Nela Research Laboratories in 1908 and who for the last few years has occupied the position of director of research of the National Lamp Works of the General Electric Company, has tendered his resignation, to take effect June 30 of this year. Dr. Hyde, who has been active in scientific and technical affairs for a number of years, has decided to take a prolonged rest abroad. He will temporarily discontinue many of his activities in the scientific and engineering societies, but will retain his office of president of the International Commission on Illumination until its plenary meeting, which is scheduled to be held in this country in 1924.

H. F. Armstrong of the Pennsylvania Power Company of Allentown, Pa., is now associated with the Georgia Railway & Power Company.

H. B. Barnes, consulting engineer of Denver, Col., is in charge of a hydroelectric power project in Hinsdale County which has been acquired by L. F. Hulen and associates from the Hinsdale Mining & Development Company and the Golden Fleece Consolidated Mining Company.

F. C. Brown, acting director of the United States Bureau of Standards, Washington, D. C., has been appointed a representative of the Department of Commerce on the American Engineering Standards Committee, succeeding S. W. Stratton, with E. C. Crittenden, chief of the electrical division of the bureau, as alternate.

Dr. August Hund, recently of the University of California, has been appointed an additional electrical engineer of the radio section of the United States Bureau of Standards. Dr. Hund was graduated from the Technische Hochschule, Carlsruhe, in 1911 and took the degree of doctor of engineering in 1913. He was employed by the General Electric Company under Dr. Steinmetz in 1915-17 and since that time has been doing graduate work at the University of California.

S. P. MacFadden, formerly secretary in the Texas district office of Stone & Webster, Inc., has been transferred to Port Arthur as superintendent of the Eastern Texas Electric Company, succeeding Joseph Bowes, who has been made general light and power superintendent of the company with headquarters at Beaumont. F. C. Taylor, formerly chief engineer of the Eastern Texas Electric Company, has been appointed superintendent of power stations.

Dean J. Locke, who has been associated for some years with Prof. Albert S. Richey of the Worcester (Mass.) Polytechnic Institute in consulting engineering activities and investigations connected with rate cases, has joined the staff of the Public Service Railway, Newark, N. J.

Dean Gardner C. Anthony of the Tufts College (Mass.) Engineering School, sailed April 19 for an extended European trip. Dr. Anthony is the founder of the New England Section of the Society for the Promotion of Engineering Education and is its present chairman. He will return about Sept. 1.

Frank A. Easton, formerly head of the gas department of the San Joaquin Light & Power Company at Bakersfield, Cal., has been promoted to the position of stock sales manager with headquarters at Fresno. His place as head of the gas department in Bakersfield has been taken by William Tyler, formerly his chief assistant.

Thomas J. Hanlon, Jr., manager of the Tampa Electric Company, a Stone & Webster property, has been made manager of the Winter Haven (Fla.) Water, Ice & Light Company, recently acquired by Stone & Webster. J. H. Fuller, formerly sales manager of the Tampa company, will be assistant to the manager with headquarters at Winter Haven, and Gettis B. Henderson will take Mr. Fuller's place as sales manager of the Tampa company.

W. E. Clement, commercial agent of New Orleans Public Service, Inc., was elected president of the Electrical League of New Orleans on April 9. Mr. Clement is an enthusiast on all matters electrical and has taken an active part in the growth and welfare of the league. Percival Stern of the Interstate Electric Company was elected vice-president, and C. A. Disher of the Electric Appliance Company was elected secretary and treasurer.

Tom P. Walker, formerly manager of the Haverhill (Mass.) Gas Light Company, has been transferred to the managership of the Baton Rouge (La.) Electric Company. J. L. Alexander, manager of the Keokuk (Iowa) Electric Company, has been transferred to Haverhill, and Walter H. Burke of the Boston office of Stone & Webster, Inc., has been appointed manager of the Keokuk company. Roger A. Gordon, formerly sales manager of the Houghton County Electric Light Company, Houghton, Mich., and later of the Paducah (Ky.) Electric Company, has been appointed sales manager of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., succeeding E. S. Roberts, resigned.

PenDell and Sedgwick Made Executives' Assistants

C. W. PenDell has been made an assistant to Vice-president John G. Learned of the Public Service Company of Northern Illinois, and H. P. Sedgwick has been appointed an assistant to Vice-president J. L. Hecht. Mr. PenDell has been associated with the Edison Electric Illuminating Company of Boston, the Chicago & Northwestern Railroad, the Atchison, Topeka & Santa Fé Railroad and the North Shore Electric Company, and for some years was an engineer in the contract department of the Public Service Company, the successor to the North Shore company. Mr. Sedgwick has been associated with the company since 1913, when he became assistant inspector. In 1921 he was made superintendent of District "E" and one year later was transferred to Chicago as a member of Mr. Hecht's personal staff.

S. C. Bleckley of the Westinghouse Electric & Manufacturing Company of Pittsburgh is now associated with the engineering department of the Georgia Railway & Power Company.

S. D. Woodward, manager of the Peshtigo & Oconto Service Company in Peshtigo, Wis., has tendered his resignation to the Northeastern Power Company, which recently assumed ownership of the local plant. Mr. Woodward was for many years affiliated with the Peshtigo Lumber Company, and when it ceased activities he was one of the promoters of the company which purchased the electric holdings. He has no plans for the future at the present time.

Lewis Degen, consulting electrical signal engineer of Berkeley, Cal., has been retained by the city of Los Angeles to supervise the installation of a fire-alarm system, to cost $1,500,000. Mr. Degen spent many years in South America and installed the first electric street railway on that continent in Rio de Janeiro in 1890. Later he acted as consulting signal engineer for the Brazilian government for eight years. He returned to the United States in 1913 and in 1914 prepared plans for a fire-alarm system for Los Angeles.

Harry B. Joyce has been appointed manager of the synchronous-motor department of the Ideal Electric & Manufacturing Company, Mansfield, Ohio. Mr. Joyce was at one time affiliated with the United Railway & Electric Company of Baltimore, handling substations, test, designs and reconstruction, and was later appointed power engineer for the United Electric Light & Power Company, New York City, in charge of all commercial power sales work, developing power applications and handling and developing new and adaptable high-tension rates. Mr. Joyce has also been consulting engineer of New York City, devoting special attention to application of electric drive for ice-making and refrigerating plants.

John D. Goodliff was recently elected vice-president of the Parr Electric Company, Inc., New York City.

Arthur P. Amond of Green Bay has succeeded George Martin as manager of the Denmark (Wis.) Light & Power Company. Mr. Martin has been manager for the past five years.

Floyd Casler, formerly manager of the Midland Public Service Company in Colby, Wis., has been transferred to the company's branch at Blair to serve in the same capacity.

Walter E. Burke of Boston has been made manager of the Keokuk Electric Company, succeeding J. L. Alexander, who leaves for Haverhill, Mass. Mr. Burke is a member of the Stone & Webster organization.

H. L. Mode, who until recently has been electrical engineer in the chief engineer's office of the Otis Elevator Company, is now in charge of sales for the Hoist & Crane Engineering Company of New York City.

Emerson A. Armstrong, formerly power salesman of the Joliet district for the Public Service Company of Northern Illinois, is now in the Chicago office as power engineer in charge of all power salesmen of the company.

G. M. Pierce of Blair, Wis., has been assigned to the Menomonie office of the Wisconsin-Minnesota Light & Power Company as district manager. Mr. Pierce has been manager of the Blair district for the last eight months.

Kenneth A. McIntyre of the field staff of the Society for Electrical Development has returned to headquarters after a 9,000-mile trip. Mr. McIntyre looks for a year of progress in co-operative work that will be of lasting benefit to every branch of the industry.

L. U. Murray, manager of the Columbus (Ohio) office of the General Electric Company, has been appointed district merchandise manager of the Cincinnati district and is succeeded by J. A. Davies as manager of the Columbus office. Mr. Davies was general salesman in the Indianapolis office until his recent appointment.

Ray P. Jackson, manager of the materials and process engineering department, and Marsden H. Hunt, ceramic engineer, of the Westinghouse Electric & Manufacturing Company, will have charge of the new high-voltage insulator plant of the Westinghouse company at Emeryville, Cal., near San Francisco. The plant is now under course of construction and will be completed and operating in a few months.

B. E. Sunny, chairman of the board of the Illinois Bell Telephone Company, was elected a director of the Middle West Utilities Company at the stockholders' meeting at Wilmington, Del., March 27. Mr. Sunny's appointment was made to fill the vacancy created by the death of Frank J. Baker. John F. Gilchrist, vice-president of the Commonwealth Edison Company, was elected a member of the executive committee.

Arthur L. Williston, for the past thirteen years principal of the Wentworth Institute, Boston, and widely known by New England electrical men, has resigned. He was formerly connected with the school of science and technology at Pratt Institute, Brooklyn, and during the war was educational director for New England army training detachments, having charge of military training departments in fourteen institutions.

George F. Staal, city engineer of Milwaukee for the last nine years, has handed in his resignation to the Mayor, to become effective at the expiration of his term on April 17. Mr. Staal will leave Milwaukee to become associated as chief engineer and general manager of the Pike Forest Development Company, in which he is personally interested, with offices in Denver. This company will carry on extensive construction and water-power work in Colorado.

Col. Frank M. Gunby, consulting engineer with Charles T. Main, Boston, has been elected president of the Boston Society of Civil Engineers. Colonel Gunby is well known in electrical circles and has been in charge of the Boston branch of the Main organization's work for some years. He has been active in hydro-electric and industrial-plant engineering. During the war he was stationed at Washington, D. C., in charge of engineering in connection with the construction of cantonments throughout the country.

P. H. Gadsden of Philadelphia has been nominated as a director from election district No. 2 on the board of directors of the Chamber of Commerce of the United States by the National Electric Light Association, the American Electric Railway Association, the American Gas Association and the Natural Gas Association. Mr. Gadsden is vice-president of the United Gas Improvement Company and is vice-president and one of the directors of the Philadelphia Chamber of Commerce. The election will be held at the time of the annual meeting of the chamber, May 8, in New York.

Willis H. Booth, vice-president of the Guaranty Trust Company of New York, was elected president of the International Chamber of Commerce at its convention in Rome on March 24. In addition to his banking activities, Mr. Booth has many large and important industrial interests. In 1910 he established the Hotpoint Electric Heating Company, which was later merged with the Hughes Electric Company and the electric heating division of the General Electric Company under the name of Edison Electric Appliance Company, with factories in California, Chicago and Canada. He is chairman of the board and of the executive committee of this corporation.

David Elwell has been appointed manager of the New York office of Lockwood, Greene & Company, succeeding Gen. W. H. Rose, who has resigned to join the organization of the American Machine & Foundry Company, New York. Mr. Elwell is well known in electrical circles, having been graduated from the Massachusetts Institute of Technology in 1904 and served with the Edison Electric Illuminating Company of Boston and the Westinghouse Electric & Manufacturing Company, representing the latter as superintendent on the electrification of the New York, New Haven & Hartford Railroad. For five years he was electrical engineer of the Boston office of Lockwood, Greene & Company, going to New York in 1920.

W. F. Hendry has resigned his position as assistant chief engineer of the Western Electric Company to become chief engineer of the Manhattan Electric Supply Company. Mr. Hendry had been associated with the Western Electric Company for almost twenty-three years.

H. T. Melhuish, formerly manager of the district sales office of the Radio Corporation of America at Chicago, has been appointed assistant general sales manager at the company's New York office. Mr. Melhuish had been associated with the Radio Corporation for only three months as salesman when he was selected for the position of district sales manager at Chicago. Previous to his connection with the Radio Corporation he was engaged in radio distribution in New York City in his own interest. For five years Mr. Melhuish has been active in radio sales work. J. M. Sawyer, who was responsible for the organization of the Radio Corporation of America district sales office at Chicago, has returned from the San Francisco office to become again sales manager of the Chicago office. Mr. Sawyer has just completed organizing the San Francisco sales department.

Obituary

Horace O. Stone, lawyer and inventor, died on April 11 at Chicago after a stroke of apoplexy. Mr. Stone invented a glass device to prevent damage by freezing of water in engines and methods of effecting saving in blast furnaces.

Fred S. Martin, superintendent of the large industrial motor department of the Westinghouse Electric & Manufacturing Company for a period of eleven years and subsequently appointed staff superintendent, died recently in the West Penn Hospital, Pittsburgh, after three weeks' illness.

Hanson M. Savage, president of the Wetmore-Savage Company, Boston, and one of the best-known electrical supply jobbers in the East, died suddenly at Boston on April 10. Mr. Savage, after some years in the service of the General Electric Company, formed, in 1906, with V. C. Bruce Wetmore, the company bearing their names.

Thomas E. Crossman, who had served the National Electric Light Association, the American Institute of Electrical Engineers and the Association of Edison Illuminating Companies for almost forty years as official reporter, died suddenly on April 4 in the Congress Hotel, Chicago, where he had gone to report the meeting of the American Railway Engineering Association.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Method of Selecting Men

A Simple Form of Question Test—Policies Toward Education, Habits and Entertaining—Other Practical Points

By R. J. Russell
Vice-President Century Electric Company, St. Louis

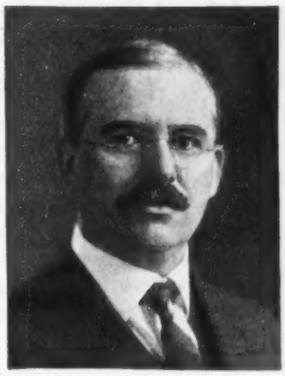
THERE are three things, we feel, that should be very carefully determined in the case of every man who is permitted to join our organization. We try to make sure of every man who enters our employ:

First—That he shall be a man of character, one who has had good home and social and educational training and has absorbed and not forgotten it.

Second—That if he does not possess the knowledge to enable him to handle the engineering end of the commercial and sales problem he will have the fundamental education that will enable him to "know how to find out."

Third—That he has made up his mind to continue indefinitely with us if he is to join our commercial organization.

I might elaborate on this at length, but, briefly, we are not attempting to operate in a corrective fashion, but rather definitely to develop ability, which is apparently quite possible.



R. J. Russell

As to Habits

We find it is best to select men who have inherited something that will be of substantial assistance in their business life. We are interested particularly that the man has been inclined to participate and has participated in society and organization work, which broadens a man's views and gives him a little confidence in himself. We are particular as to how he spends his Sundays, Saturday afternoons, holidays and evenings, and, if he is married, we want to know whether he spends them with his family or not.

Our experience shows that when the diversion indulged in by an individual after business hours, or the lack of physical and mental relaxation, leaves him in the position of, consciously or unconsciously, using the morning (especially Monday) to recuperate, he is not generally able to contribute that concentrated thought and determination to his business, or promptly to render the decisions which are required, that will enable him to keep up with those who are forced by the demands of the work to secure definite results. As a general proposition, he can hardly be considered as headed for the ultimate position of substantial responsibility and trust which we are hoping all will be qualified to fill if or when it is offered.

As to Education

We are not placing any one in a position above an ordinary clerkship in our commercial and sales organizations who does not possess a college education. Those who have acquired a technical education outside of a college are generally a little older than we find economical to try to break into our ways. They cannot so readily understand and absorb our practices and policies. We must have technically trained men, otherwise we would not possess the man who "knows how to find out" when he does not know the answer to the question or problem that is given him to solve. For many other departments in our works the standard practice is to hire college men; but elsewhere also, in the majority of cases, those who expect to rise above the point of workmen must have at least a high-school education.

In hiring men for our commercial organization we want them as soon after they come from college as possible, so that we may train them with the minimum effort to believe in and observe the plans and practices and policies of the Century Electric Company and so that they may feel they are an inherent part of the organization.

Analyzing Character

In examining men for employment in our commercial organization we require them to answer a series of very exacting questions, which we study with close scrutiny and find extremely helpful in analyzing character and weighing the value of a man to us. We secure a frank statement on the following points, different application forms being used for different departments:

1. Age.
2. Where have you lived, and the number of years spent in each place?
3. Father's or guardian's business now.
4. Nationality.
5. Descent.
6. Height.
7. Weight.
8. Supply late photograph with this record.
9. Physical defects.
10. Married or single?
11. Number of children.
12. Do you smoke cigarettes?
13. Do you use alcoholic liquors in any form?
14. Schools attended, name and location, course, how long, year graduated, degree: High school, preparatory, college, university, technical.
15. What manual training have you received at school?
16. Mention the most important studies you have taken in high school and university and have received satisfactory credits for, also studies you liked best.
17. What was the subject of your thesis upon graduation?
18. School work enjoyed most.
19. Scholarship record (your own opinion).
20. Scholastic honors.

21. Part taken in athletics, class organization, students' societies, etc.—offices held.
22. What societies are you a member of—educational, social, religious, fraternal, etc.—and what part taken in each?
23. All practical experience, including remunerative work during vacations or high school and university periods in order of date.
24. What experience, if any, have you had in selecting and applying motors for and to installations and apparatus?
25. If not answered above, what knowledge have you of single-phase and polyphase motors and fans, both theoretical and practical, and where did you acquire it?
26. Detail your sales experience if any.
27. Outline the division of engineering which you most desire to follow—factory, production, design, sales.
28. What languages have you studied?
29. What languages do you speak (state whether fluently or partially)?
30. Detail your connection with Century Electric Company.
31. Are you ready to go anywhere in the United States that we may designate?
32. State the particular line of work and class of apparatus, if any, on which you are now or have been making a specialty.
33. Name and address of firm with which you are connected at present, and your position.
34. Are you seeking temporary or permanent position?
35. Why do you wish to become connected with Century Electric Company?
36. Per cent college expenses earned.
37. Present financial obligations.
38. How do you spend your evenings?
39. Mention some of the books and magazines you have read during the past year.
40. General remarks bearing on your application that are not covered elsewhere herein that will help in arriving at a just decision as to whether to engage your services or not.
41. General impressions of interviewer: Appearance, approach, attitude, breadth, character, decision, expressiveness, enthusiasm, health, judgment, personality, quickness, refinement, tact, work best suited for.

A FEW REQUIREMENTS

Among our requirements are that the man must stand at least 5 ft. 8½ in., weigh not less than 140 lb. and be not less than twenty-two years of age. He must not smoke cigarettes or use intoxicating liquors. The Century Electric Company has never since it was organized allowed five cents for entertainment. The reason is that we expect our men to compete for business but not to compete in any "cafe endurance" contest, which in practice results in the salesman trying to entertain a different guest at least once a day. If we did not establish this rule, our salesmen would be worn out physically about the time they should amount to something to themselves and to us commercially.

We have no place in our organization for the man who is looking for experience, and we are particularly careful in selecting men in seeing that they take their time to investigate our company and our organization from all angles. We suggest many of the angles from which they do their investigating, being sure that we are not at all biased, so that when a man does come with us he is practically certain to stay.

As far as we can recall, no man connected with our sales organization who was technically educated and trained in our works and in the general office has left and gone with a competitor, except one case. A family reason caused that decision.

Our educational department consists of an educational director and an assistant director, who preside over our student employees, and an assembly room seating about 150. These men are looking after the routing through the works of from six to fifteen college men, from fifteen to fifty high-school graduates destined for foremen, clerical and directing positions, and from twenty to thirty young workmen apprentices all the time.

Wanted: More Open Minds

More Liberal Co-operation Needed from the Trade in Marketing New Electrical Conveniences

BY A MANUFACTURER'S SALES ENGINEER

SOME years ago there was developed an electrical household convenience which was designed for usefulness in the kitchen, and now a company with which I am connected is trying to market this device. We manufacture no other household products, but are hoping to build up a sound and extensive business through the successful application of this equipment in many parts of the country. Why does the progress of this appliance make such moderate headway?

When intelligently applied to kitchen requirements, this device does its work better than the older competitors operated by other agencies than electricity. Yet it is like the proverbial " pulling teeth" to get the local central-station sales department executive interested in its application, and we find it almost as hard to arouse the electrical supply jobber and the dealer to the possibilities of its proper utilization.

Not only because I am personally interested in seeing this device take its place among recognized standard equipment for the home do I appeal for more co-operation. Every manufacturer of a comparatively new device will appreciate the difficulties of interesting the utility man, the jobber and the retailer in a modest piece of equipment like this, selling for far less than $100 in a common size, and requiring only the will to push it to insure popularity. I suppose that the trouble lies in part in the idea of many executives of central stations that the device in question is attacking a field of service which has often been looked upon as barren to commercial exploitation. It is unnecessary to state what this service is in order to make the point I wish to drive home, viz., that the men of this industry should never "freeze" to the conclusion that because some problem has been unsolvable it is bound to continue so.

So widespread is this impression among many central-station sales managers, for instance, that it is difficult to get complete trial installations on their own systems, and yet now and then one or another utility executive will put the outfit into his home, "try it on the dog" as it were, and then some day Mr. Sales Manager finds out that the "big boss" has one of these things under his own roof, that it works properly, and hence that it will work elsewhere. It ought not to be the case that the easiest avenue of approach to the sales manager in the lighting company or the jobbing establishment is sometimes via the "overhead" route passing through his superior's demesne.

So I ask that sales leaders throw their minds a little wider open in considering and trying new electrical devices; that they refrain from the error (centuries old) of supposing that because a scheme failed to work years ago, it is no good today. We, for instance, offer them a device which will do better work than its competitors made outside the electrical industry, and I frankly believe that a greater willingness to give such apparatus a more comprehensive try-out will be productive of good to the industry and to the waiting public.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

WITH the increasing demand for motors in various parts of the country, heavy pressure is being put on manufacturers to meet present requirements, and the time has now come when prospective purchasers will have to reckon on lengthening deliveries on orders involving even fair-sized total ratings of the more common machines. Experience of many years has shown manufacturers the wisdom of "long-distance" production and of the up-building of local stocks for the more immediate demands of the market, and at present a vigorous effort is being made to complete and maintain at least moderate stocks of the smaller integral-horsepower motors. A buying movement has begun to set in in some quarters in anticipation of possible price advances. It may fairly be said that many motor stocks are spotty, taking the country as a whole; but thus far no serious inconvenience appears to have been sustained from the fact that these stocks are being reduced, notwithstanding 100 per cent capacity output in representative plants.

Competition Is Still Acute

IN SOME circles the opinion is still heard that competition is an adverse factor in the motor business, particularly in regard to margins of profit allotted to sales representatives. While it is true that there are a great number of motor producers in the field at this time, it is felt in some quarters that the real test of business-getting capacity is service. As stocks diminish, the sharpness of competition tends to increase; but the line of best results in building and maintaining a motor business appears to be that of intelligent application engineering and modern sales facilities, with all that these mean in the way of gaging requirements and holding interest in performance after sales.

Betterment Work Never Stops

LOOKING into the distant future of the electrical industry, it is still impossible to discern a zone of complete saturation in motor applications in this country. Not only do the natural and still undeveloped resources of America beckon the motor builder to new achievements, but the constant changes in industry and the progress of application engineering are continually pointing the way to new sales. Transformations of war-material plants into establishments devoted to the production of other kinds of commodities have been completed in many localities. A great machine-gun factory is today turning out fuses, switches and other distribution material. Another is making electric starting and lighting systems for the automobile industry. Revolutionary changes in motor installations have gone along with such transitions, and the ceaseless fight against industrial waste takes close note of load variations in many plants whose product has not been changed in kind, although it has in quantity, during the past five or ten years. The immense stocks of used motors thrown upon the market at the close of the war have been absorbed into industry with slight effect upon prices as a whole, and the progress of new designs has stimulated interest in power problems throughout the trade.

Record-Breaking Sales of Heating Pads Are Reported

AN UNPRECEDENTED demand for heating pads during the past four months has led to a marked increase in production in factory circles, and this has been sustained throughout the winter without the usual seasonal slump in orders. Some overtime work is necessary to keep up to the current volume of business, and it is impossible to build up any substantial stocks under present conditions. The supply of raw material for pads is reported ample as a result of manufacturing anticipation of requirements. The care required to produce reliable and satisfactory pads makes it necessary to build up factory forces gradually for such work. Labor is in fairly good supply. Prices are firm and little prospect of early change is evident. This class of equipment is rapidly getting into the staple line, and vigorous advertising effort, coupled with an unusually severe season in the northern part of the country, has contributed to the present satisfactory situation.

Range Business Hitting Faster Stride as Spring Sets In

IMPROVEMENT in the electric range trade is in general evidence as spring demand opens wider. Manufacturers are increasing their production schedules and look for a substantial year's business. So far few complaints of labor shortage have found wide circulation, and raw materials are in fair supply for current needs. There is some prospect, however, of material scarcity before the end of summer. Deliveries are in good shape and the trend of prices is upward in some quarters. A great deal of study is being given to the marketing of electric ranges by both manufacturers and central stations. The growth of installment campaigns in central-station circles is helping to popularize electric cooking, but the full benefits of mass production have not yet been attained in the manufacturing plants. New England is rather apathetic at the moment as to range purchases, but the Far West and the South are showing new interest, and both inquiries and purchases are coming in at a much faster rate than a year ago. The central-station rate situation is getting better constantly, from the manufacturer's viewpoint. The continued high cost of domestic fuel and the improved automatic and convenience features which different range makers are developing are bringing the range home to the public in a more definite way than formerly.

Conduit Boxes in Easy Supply

JUDGING from reports of Eastern distributors, any troublesome delays in the transportation of conduit boxes which were experienced during the winter have given way to an ample supply. Steady sales are being handled in connection with the building expansion program of the country, and prices are unusually free from violent fluctuations. The ups (and downs that were) of black and galvanized pipe quotations find little reflection in box prices.

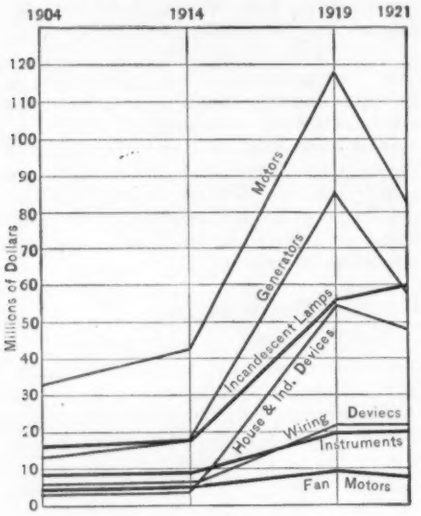
An intelligent attention to future requirements is, of course, necessary in handling this class of material, but so far the steel industry has given the jobber and the contractor very little trouble in relation to a fairly even stock maintenance in local centers from which the supply of conduit boxes are distributed.

Purchasers Help Transformer Standardization

RECOGNITION by the transformer manufacturers of the co-operation of purchasers in standardization work is a gratifying sign of mutual understanding. Few buyers of transformers are perhaps in a position to contribute directly to the progress of engineering design in this field, but the willingness of more and more users to adapt their requirements to well-considered established types and ratings of equipment is helping to reduce superfluous production and so to keep down costs in a broad sense. A leading transformer engineer stated last week that plant and system operators have shown about as much active interest in standardization as the manufacturers, the collective result being along the line of elimination of undue variations from established equipment in specifications. Some operators may at times call for special combinations wherein a standard rating can be made to satisfy their needs, and each time that the decision is made to play the standard game the industry receives some benefit. All signs point to a continuance of this co-operation, and publicity on the part of operators and manufacturers is helpful to the cause.

Chart Shows Some Interesting Production Values

ACCORDING to recent official figures by the Department of Commerce, the 1921 value of motors and parts, not including starters and controllers,



IMPORTANT 1904-1921 VALUES

amounted to $83,058,000; generating apparatus and parts, $58,861,000; incandescent lamps, $59,728,000; household and industrial devices, $48,815,000; wiring devices, $21,806,000; instruments, $21,033,000, and fan motors, $8,611,000. Production values for the census years 1904, 1914 and 1919 are indicated as shown in the accompanying chart.

Industrial Electric Trucks Are in Better Demand

IN BOTH proposition work and sales manufacturers of industrial electric trucks are enjoying decidedly increased activity, following a long period of comparatively dull business. The effective use of these labor-saving equipments depends fundamentally upon the existence of a volume of material handling sufficiently large to keep them occupied a large portion of the working day, and in times of business depression industrial plants tend to become overequipped as well as overmanned. Sales of trucks at such times are consummated only with difficulty unless the economic balance in favor of the truck is so marked as to rebuke the intelligence of the purchaser who fails to substitute it for man-power.

Truck Sales Start Other Equipment

EQUIPMENT of this type is again in demand to help solve the problems of internal transportation in factories and yards, on docks and at important railroad terminals. A projected new railroad terminal or union station may open a market for two dozen mail and baggage-carrying types, and labor shortage and high costs are turning the attention of specification writers in designing engineers' offices concerned with the above work to industrial truck requirements. Along with these comprehensive layouts for service of trucks in small fleets go demands for the latest types of battery-charging equipment, with a tendency toward the use of automatic control panels and an increased number of energy-recording instruments. The marketing of such equipment is essentially engineering salesmanship, and while competition among the dozen or so representative truck makers is active, the decision to buy particular units rests upon many other conditions than price. Present activity in this line is a most encouraging index of industrial prosperity.

Manufacturing Industry Had 5.16 per Cent Labor Shortage

EXTENSIVE survey of the labor supply situation has just been completed by the National Industrial Conference Board. The object has been to establish whether labor shortage exists, and, if so, how much of a shortage and in what industries and where.

In the electrical manufacturing industry the board states that the March employment index number (July, 1914, equals 100) amounted to 147.7; that the total per cent of unfilled positions to the total employment of all firms in the electrical industry, as of March 15, was 4.72, and that the percentage of unfilled positions to employment in firms reporting shortages amounted to 5.16. Information from 1,011 firms in various parts of the United States, employing 369,405 wage earners and selected from practically every line of industry, it is stated, shows that there existed a labor shortage amounting to 2.5 per cent of the total employment on March 15. Of the firms reporting, 315 stated that they had unfilled positions due to inability to secure workers. These 315 firms employed 175,387 wage earners and could have employed 9,800 additional persons on March 15, according to the survey.

February Electrical Exports Heavier than in 1922

TOTAL exports of electrical machinery, apparatus and appurtenances for the month of February were $4,839,738, a gain of $454,344 over February, 1922, when the total amounted to $4,385,394. The following figures are supplied by the Bureau of Foreign and Domestic Commerce:

ELECTRICAL EXPORTS FOR FEBRUARY, 1923, COMPARED WITH CORRESPONDING PERIOD A YEAR AGO

Articles	Value — February — 1922	1923
Electrical machinery, etc.		
Turbines	$228,483	$57,084
Generators:		
Direct-current—		
Under 500 kw.	26,565	60,710
500 kw. and over	11,962	114,726
Alternating-current—		
Under 2,000 kva.	11,302	23,926
2,000 kva. and over	49,624	102,946
Accessories and parts for generators	18,412	20,523
Self-contained lighting outfits	22,498	25,972
Batteries:		
Primary	72,243	98,073
Storage	85,363	182,454
Transforming and converting apparatus:		
Transformers—		
Power	231,431	280,135
Other	119,397	38,418
Rectifiers, condensers, double-current and motor generators, dynamotors, synchronous and other converters	57,468	17,405
Transmission and distribution apparatus:		
Switchboard panels, except telephones	43,063	68,481
Switches and circuit breakers above 10 amp.	177,613	127,942
Fuse and fuse blocks	13,181	19,261
Meters and measuring instruments:		
Watt-hour and other measuring instruments	68,672	19,962
Volt, watt, and ampere meters and other recording, indicating, and testing apparatus	40,353	79,258
Lightning arresters, choke coils, reactors and other protective devices	20,907	58,310
Motors, starters and controllers:		
Motors under 1 hp.	30,612	117,076
Stationary motors 1 to 200 hp.	169,604	182,874
Stationary motors over 200 hp.	54,271	107,027
Railway motors	19,963	13,167
Electric locomotives —		
Railway	36,329	5,570
Mining and industrial	38,655	30,238
Other motors	.....	.....
Rheostats, controllers and other starting and controlling equipment	63,697	72,661
Accessories and parts for motors	57,859	83,899
Electrical appliances, etc.		
Electric fans	77,229	122,725
Electric lamps:		
Incandescent—		
Carbon-filament	8,204	1,141
Metal-filament	120,830	89,403
Other electric lamps	14,658	16,870
Flashlights	11,077	29,391
Searchlights and projectors	34,567	49,522
Motor-driven household devices	37,817	64,003
Domestic heating and cooking devices	30,511	73,716
Industrial electric furnaces and ovens	2,647	5,584
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	33,855	50,385
Signal and communication devices:		
Radio and wireless apparatus	283,950	173,909
Telegraph apparatus	17,688	37,734
Magneto telephones	*	5,544
Other telephones	430,559	14,875
Magneto switchboards	*	5,156
Other telephone switchboards	*	59,630
Railway signals, switches and attachments	9,338	109,427
Bells, buzzers, annunciators, and alarms	2,641	6,454
Other electrical apparatus and appurtenances:		
Spark plugs, magnetos and other ignition apparatus	55,425	64,783
Insulating material	50,561	95,118
Metal conduit, outlet and switch boxes	24,005	32,058
Sockets, receptacles, and lighting switches	13,795	76,503
Other wiring supplies and fixtures	74,063	115,671
Other electrical apparatus not elsewhere specified	715,134	679,311
Globes and shades for lighting fixtures	23,883	38,927
Electrical glassware, except for lighting	20,522	141,160
Electrical porcelain	194,455	145,912
Electrical carbons, carbon brushes and electrodes	30,536	103,877
Insulated wire and cable (iron or steel)	11,736	40,686
Other manufactures of aluminum	56,333	44,673
Copper:		
Bare wire	71,770	125,606
Insulated wire and cable	158,078	211,886
Total electrical exports	$4,385,394	$4,839,738

(*) Not separately stated prior to Jan. 1, 1923.

The Metal Market

Sales of all metals are in smaller volume with prices generally holding steady. Metal in the market is used soon after delivery, and there is little of it in speculative hands. Most of the copper producers are holding at either 17.25 cents or 17 cents, delivered, level, but are doing little business. The St. Louis lead market is quiet, with most of the sales for small quantities and for April delivery or shipment, consumers preferring to postpone orders for May requirements as long as possible in the hope of a further weakening of the market.

NEW YORK METAL MARKET PRICES

	April 11, 1923 Cents per Pound	April 18, 1923 Cents per Pound
Copper, Electrolytic	17.37½	17.00 to 17.25
Lead, Am. S. & R. price	8.25	8.25
Antimony	8.75	8.75
Nickel, ingot	30.00	28.00 to 30.00
Zinc, spot	7.55	7.37½
Tin, Straits	48.00	47.50
Aluminum, 98 to 99 per cent.	24.00	26.00 to 27.00

March Delinquent Electrical Accounts Show Increase

REPORTS from the National Electrical Credit Association show that in the five sections reporting to the association the March, 1923, delinquent electrical accounts increased over February, 1923. In the Chicago territory the average amount jumped from $107.49 to $131.49. For the New York territory in March, 1923, 584 accounts were reported as against 283 in February, 1923, with a total valuation of $73,655 as against $36,045. The Philadelphia accounts for March, 1923, were $204 against $176 for February of the same year. Conditions in the New England territory for March, 1923, were much better than in March, 1922, since only sixty delinquent accounts were reported as against 129 delinquent accounts for the last year. On the Pacific Coast the number reported for March, 1923, totaled forty-eight against fifteen reported in February, although the average amount for this same period had decreased $126.12. The March delinquent accounts are as shown in the accompanying table.

DELINQUENT ACCOUNTS IN MARCH

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
February 1922	638	$97,311.30	$116.12
February 1923	635	69,996.47	107.49
March 1922	978	98,569.53	100.79
March 1923	993	130,571.90	131.49
New York:			
February 1922	393	63,082.00	160.00
February 1923	283	36,045.00	127.00
March 1922	643	72,843.00	113.00
March 1923	584	73,655.00	126.00
Philadelphia:			
February 1922	126	16,878.00	133.95
February 1923	176	26,881.67	152.73
March 1922	277	28,095.09	101.42
March 1923	204	26,386.27	129.34
New England:			
February 1922	59	5,214.64	88.39
February 1923	48	2,495.35	51.99
March 1922	129	11,170.85	86.59
March 1923	60	4,782.71	79.71
Pacific Coast:			
February 1922	14	806.45	57.63
February 1923	15	4,245.63	283.04
March 1922	18	2,681.95	148.99
March 1923	48	7,522.26	156.92

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

DURING the week increased activities were reported in the market for appliances, especially fans, flatirons and toasters. Large orders for equipment to the utilities are reported in the West and Middle West. Motor sales in New England are said to be twice as satisfactory as one year ago, with this ratio applying even to the smaller producers. Replacements and increasing construction are doing much for lamp distributors. The fixture market is improving with much intensive selling effort. Collections throughout the country are unimproved.

Boston Little change in conditions is apparent, business holding its own in nearly all lines. Wire is moving very actively as the construction season develops and prices have stiffened in flexible armored conductor and high-tension insulators. Shortages continue in radio tubes, and the arrival of rigid conduit is delayed in some cases by railroad terminal congestion. Appliance sales are doing well, and heating pads are making new records in production. Motor sales in this territory are certainly twice as satisfactory in volume as a year ago, and this ratio applies even to the smaller producer. The upward pressure of prices is almost continuous. General business in New England is excellent, barring some retail slumps due to poor weather. The great industries of this section are intensively active. Financial conditions are well in hand.

New York Steady demand is the feature of a market of slightly increasing prices and unusually even stocks. Several decreases in prices of wire, devices and radio are expected at the end of two weeks because of lower raw-material costs. Orders for fans are being promptly filled, and jobbers are most optimistic about the season's possibilities. Conduit stocks are much improved. Collections are only fair.

Atlanta Spring weather is ushering in a large amount of additional outdoor work of various types and a shortage in crude labor is beginning to be felt. Skilled labor, while fully employed, still seems to be sufficient for demands, but there is no excess in the territory. Industrial establishments generally are on full or overtime operation, with the outlook excellent for a continued activity throughout the summer and early fall. Rains are preventing the planting of cotton, and this is causing some uneasiness in the rural communities. Electrical dealers report their business as good, particularly in building and line materials. Shipments on conduit have improved and stocks are better.

Pittsburgh The activity among the industrial companies is especially noticeable. Increased buying is being done by them in the electrical line, requisitions becoming larger. It is reported that one industrial firm bought electric tractors during the week to the amount of $100,000. There is a decided increase during the week on armored cable and a slight increase on some conduit fittings. There was a slight drop in copper, although this has not as yet had any effect upon wire prices.

Cleveland The week has been a favorable one for jobbers, who report sales far in excess of the same period last year. Stocks are in good shape except for those products containing copper. Manufacturers are most concerned about the labor scarcity and the increasing costs of production. Prices are advancing slightly on lamp cord, weatherproof wire, conduit, tape, porcelain, transformers, insulators and switch boxes. Appliances are in fair demand and central-station expansion continues satisfactorily.

Chicago Business has remained quite active, with several announcements of increased prices. Flexible armored conductor increased $5 per 1,000 ft. and connecters increased $3 per 1,000. Motors rated at 250 hp. and above have increased 10 per cent. It is extremely difficult to obtain 1½-in. locust pins, since this size is almost entirely depleted. Building permits issued the first week in April amounted to $21,996,000, or nearly $5,000,000 more than in the whole month of April, 1922.

St. Paul-Minneapolis Jobbers say business is slow. The brisk buying of the winter months on a rising market has stopped. Construction in both cities continues excellent. Minneapolis construction is fair, but several large projects have been postponed because of high prices. The big radio and appliance exposition at the Minneapolis armory is drawing large crowds.

Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week Reports will include Instruments, Farm Lighting Plants and Irons

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High-Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Radio	Conduit Boxes	Dry Batteries	Tape
Boston																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Low	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml.	Low
Price trend	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Inc.
New York																			
Demand	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.
Supply	Nml.	Nml.	Low	Nml.	Low	Nml	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.
Price trend	Firm	Inc.	Firm	Firm	Firm	Inc.	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Inc.
Baltimore																			
Demand	Act.	Slow	Act.	Sdy.	Slow	Slow	Sdy.	Slow	Act.	Slow	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Sdy.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Atlanta																			
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Act.	Act.
Supply	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Pittsburgh																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
Cleveland																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.
Supply	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.
Chicago																			
Demand	Act.	Sdy.	Act.	Act.	Act.	Act	Sdy.	Act.	Sdy.	Act.	Act	Act.	Act.	Act.	Act.	Act.	Sdy.	Act.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Inc.	Firm	Firm	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Paul-Minneap.																			
Demand	Act.	Slow	Act.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Firm	Firm	Inc.	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Dec.	Inc.	Firm	Firm
St. Louis																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Slow	Sdy.	Sdy.
Supply	Low	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	High	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
New Orleans																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Slow	Act.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Denver																			
Demand	Act.	Sdy.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow	Act.	Slow	Sdy.	Act.	Act.	Act.	Slow	Act.	Act.	Sdy.	Sdy.
Supply	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Salt Lake City																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Act.	Sdy.	Sdy.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	High	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Portland-Seattle																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml	Nml	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Inc	Firm	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Act.	Act.	Sdy.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Inc.	Firm	Dec.	Firm	Firm	Firm	Firm	Firm

St. Louis Activities in the building industry are being well sustained. The building permits for the month of March amounted to $4,237,585, which is an increase of 136 per cent over the same month in 1922. The car shortage has been improved by the reduction of bad order equipment and the delivery of new cars. In electrical lines jobbers report large stocks of conduit boxes. There has been a slight increase in some of the prices of schedule material, and increases are looked for in several other lines before very long. The sale of electrical appliances for the first quarter of the year has been more than 30 per cent greater than during the same period in 1922. Collections in retail circles are much improved.

Denver Business is good, though conservatism and caution are being exercised in placing of orders. Industrial plants are temporarily leading the field in new electrical business. Prices in nearly all lines are strengthening. Appliances and lamps are moving steadily. Range business in the Arkansas Valley is booming.

Portland-Seattle Construction continues active, and electrical permits for the first three months of this year were appreciably greater than for 1922. Most stocks are in very satisfactory shape, although Seattle still reports a shortage of conduit. Slight price increases were noted in a number of lines and further advances are expected. Labor is scarce and wages are increasing. Radio demands are decreasing in the cheaper sets, but the better-class sets continue active.

San Francisco Contractors' and jobbers' staffs are going at top speed, every available electrician is working, and several jobbers have increased their sales forces. Dealers' business is markedly better, especially in radio material and small heating appliances. Several big orders and inquiries are reported, such as for $50,000 worth of cross-arms from a power company, several 10,000 socket and plug orders from local manufacturing plants, 50,000 ft. assorted lamp cord and about $2,500 worth of safety switches.

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Phoenix Light Company Sales Made Large Increase

Negotiations have been closed by the Phoenix Light Company, Milwaukee, for 20,000 sq.ft. of additional factory space at 531 Market Street, adjoining the company's present plant. The building consists of four stories and basement and will house the lamp department.

Company officials report an increase of 56 per cent in sales for the first quarter of 1923.

American Insulated Wire & Cable Now Making Magnet Wire

The American Insulated Wire & Cable Company, Chicago, is now manufacturing magnet wire, having begun operations April 1. Its products are sold under the trade name "A-1 magnet wire" and consist of the following: Plain-enameled, single-cotton-covered, double-cotton-covered, single-cotton-enameled, double-cotton-enameled, single-silk-covered, double-silk-covered, single-silk-enameled and double-silk-enameled.

A factory manager has been engaged who has had twenty years' experience in this field and has developed magnet wire for two of the largest companies in the United States making this product. During that period he has supervised the production of upward of 60,000,000 lb. of magnet wire to meet every condition in use. He has both technical and practical knowledge of the uses of wire as well as of its manufacture.

Westinghouse Receives Milwaukee Power Transformer Order

The Milwaukee Electric Railway & Light Company has ordered nine power transformers from the Westinghouse Electric & Manufacturing Company.

The order included one 3,000-kva., OIWC-SC three-phase, 60-cycle transformer of 27,600 volts and 13,800 volts high tension, 2,300 volts low tension, to have 2,200 kva. capacity without water in the cooling coils; two 3,000-kva. OISC three-phase, 60-cycle transformers, 27,600 volts and 13,800 volts high tension, 2,300 volts low tension; two 2,000-kva. OISC three-phase, 60-cycle transformers, 27,600 volt and 13,800 volts high tension and 2,300 volts low tension, and four 1,667-kva. OISC single-phase, 60-cycle transformers, 132,000 volts star high tension, 27,600 and 13,800 volts low tension.

The first five transformers are for substation use, to step down from the 27,600-volt network of the company to 2,300-volt circuits. The others are part of the equipment required for establishing a 132,000-volt line and connecting it to the 27,600-volt system at different points.

Superior Switchboard Absorbs Meter Devices in Expansion

The Meter Devices Company and the manufacturing division of the Electric Motor & Engineering Company have been absorbed by a new corporation called the Superior Switchboard & Devices Company, Canton, Ohio.

The Superior Switchboard & Devices Company is moving into a new factory building with approximately six times the floor space of the old building. The executive personnel of the Superior Switchboard & Devices Company will be practically the same as was formerly connected with the Meter Devices Company and the manufacturing division of the Electric Motor & Engineering Company.

This change in name and location allows for an expansion that was needed. The Superior Switchboard & Devices Company will manufacture switchboards, panelboards, power-meter testing devices, steel boxes and kindred articles.

Chain Battery System Moves Plant to Kansas City

The Chain Battery System, a company manufacturing storage batteries, has recently moved its plant and headquarters from Carthage, Mo., to Kansas City, where it has purchased a brick building at 1321 Virginia Avenue which is to be used as a factory. This company, which also is a wholesale distributor, is two years old and has assembling plants in Wichita and Chanute, Kan.; Carthage and Springfield, Mo.; Tulsa, Okla., and Fort Smith, Ark. C. E. Nordyke is its president.

Western Electric to Build New $1,000,000 Warehouse

The Western Electric Company announced last week its intention to build a new merchandise building at its Hawthorne works in Chicago at a cost which is expected to be well in excess of $1,000,000. The new building will supplement the warehouse facilities at that plant and relieve a situation which has forced the company to rent 200,000 sq.ft. of storage space in buildings outside its Chicago plant.

The new structure will be four stories high and will have a floor space of 100,000 sq.ft. Ground will be broken within the next six weeks and the warehouse will be ready for use by early autumn.

S. A. Woods Machine Company Enlarges Line

Increasing demand for motors is reported by M. F. Fitch, sales manager motor division, S. A. Woods Machine Company, Boston, business now running well over 50 per cent above that of a year ago. During the past few months the company has purchased and installed a number of additional machine tools, thereby increasing the proportion of motor production space allotted to this department, and additional employees have been engaged.

Mr. Fitch stated last week that foreign orders are increasing, notably from Japan, China and Australia. The company has been able to keep in line with the demand by careful advance ordering of raw materials and has lately increased its line to include motors up to 50 hp. rating. Some improvements in design are announced, and the outlook for the year is most favorable.

G. E. Orders for First Quarter Show Gain of 56 per Cent

Orders received by the General Electric Company for the three months ended March 31 amounted to $80,010,045, according to an announcement just made to stockholders by President Gerard Swope. This is an increase of 56 per cent over a similar period last year, when orders totaled $51,335,300.

The International General Electric Company, Inc., reports net sales of $20,212,257 during 1922, against $38,359,012 in 1921. Despite the sharp falling off in total income, the profits for the year were larger than 1921. Net profits for the year totaled $2,265,477, which, after allowing for preferred dividends, left a balance equal to $15.65 a share on the $10,000,000 capital common stock outstanding, against $12.73 a share in 1921.

	1922	1921
Net sales	$20,212,257	$38,359,012
Other income	1,196,028	2,581,649
Total income	$21,408,285	$40,940,661
Cost of sales, expenses and taxes	18,803,944	37,714,544
Interest	338,864	1,254,044
Net income	$2,265,477	$1,973,073
Preferred dividends	700,000	700,000
Surplus	$1,565,477	$1,273,073

The balance sheet on Dec. 31, 1922, reported net current assets of $9,258,440 and net current liabilities in the form of notes and accounts payable of $4,715,240.

Robbins & Myers Open New Sales Office in North Carolina

The Robbins & Myers Company, Springfield, Ohio, manufacturer of electric motors, generators and fans, has opened a new sales office in Charlotte, N. C., 217 Latonia Building.

Albert Milmow has been placed in charge of this office. Mr. Milmow has had many years' experience with electrical equipment and is a specialist in the textile field.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase and agency is desired in New Zealand (No. 6,018) for small electrically driven refrigerators having a capacity up to one-eighth of a ton, direct-current, self-acting and self-contained, for use in private residences and hotels.

Purchase and agency is desired in Mexico (No. 6,019) for a small automatic electric machine for grinding ice and filling glasses, the placing of the glass making the electrical connection.

Purchase is desired in South Africa (No. 6,020) of lighting fixtures, electrotherapeutic equipment and signal system of sanitarium.

HADJI BEY ET CIE, McCurtain Street, Cork, Ireland, would like to receive catalogs of electrical novelties, mechanical figures, etc., for window display in a confectionery establishment.

PROPOSED EXTENSION TO THE HAVRE ELECTRIC SYSTEM.—The Société Havraise d'Energie Electrique has secured a fifteen-year extension of its concession to supply electrical service in Havre. A number of extensions are contemplated, including the installation of a 30,000-volt distribution cable connecting the station at Havre with the plant at Zainville, additions to both power stations, and erecting a telephone line connecting up the power houses and substations. The company will increase its capital stock from 25,000,000 francs to 45,000,000 francs to finance the work.

ELECTRIC SYSTEM FOR BATHURST, AUSTRALIA.—Permission has been granted the Municipal Council of Bathurst, New South Wales, Australia, to appropriate £40,000 for the installation of an electric system for the city, on which work will begin at once.

POWER PLANT FOR THE PROPOSED SUGAR MILL IN BRISBANE, AUSTRALIA.—Plans for the proposed sugar mill to be erected by the state government in the Tully-Banyan district, to cost about $2,000,000, include a power plant. The Australian Sugar Producers' Association is interested in the project.

AUXILIARY STEAM PLANTS NEEDED IN JAPAN.—As the hydro-electric companies in Japan have awakened to the fact that their present systems are inadequate to meet the demands at all times without auxiliary steam power stations, *Commerce Reports* states, there should be a good demand for equipment for steam-power plants. Shortage of water has become an annual problem in Japan, and for this reason it is recognized that an auxiliary steam-power plant is necessary for practically all hydro-electric plants if the companies are to be able to fulfill their contracts.

New Apparatus and Publications

SLOTTING MACHINE.—The Martindale Electric Company, Box 35, Station C, Cleveland, has placed on the market a new commutator slotting machine.

ELECTRIC PUMP JACK.—An electric pump jack which will convert the ordinary farm pump into an electric pump is manufactured by the Cullman Wheel Company, Chicago.

FLOOR-GRINDING MACHINES. — The Campbell Machinery Company, Wollaston, Mass., is manufacturing a floor-grinding and polishing machine.

ELECTRIC WAX POT.—An electrically heated wax pot has been placed on the market by the Acme Electric Heating Company, Inc., 1217 Washington Street, Boston.

TURBO-GENERATOR SETS. — Bulletin No. 21 issued by the Wellman Turbine Company, Oshkosh, Wis., covers the "Wellman" turbo-generator units.

TURBO-BLOWER.—The Wellman Turbine Company, Oshkosh, Wis., is distributing bulletin No. 10, describing the "Wellman" undergrate turbo-blower.

PLURAL PLUGS.—The Benjamin Electric Manufacturing Company, 847 West Jackson Boulevard, Chicago, is distributing a circular covering the use of six plural plugs.

HAND SHAPER.—The R. L. Carter Company, Syracuse, N. Y., has recently placed on the market a hand-type shaper for the woodworker, designed to use with a 1/9-hp. Westinghouse motor.

HIGH-TENSION SWITCHES.—The Pacific Electric Manufacturing Company, 827 Folsom Street, San Francisco, has issued three bulletins, Nos. 1,401, 1,500 and 1,600, covering its various types of high-tension switches.

GRAPHIC INSTRUMENTS. — "Some Things Being Done With Graphic Instruments" is the title of bulletin No. 223 issued by the Esterline-Angus Company, Indianapolis, Ind.

OUTDOOR EQUIPMENT.—Schweitzer & Conrad, Inc., 4435 Ravenswood Avenue, Chicago, is distributing bulletin No. 202, describing the "S & C" high-voltage outdoor equipment.

BATTERY-CHARGING OUTFITS.—The Hobart Brothers Company, Troy, Ohio, is distributing leaflets covering the "HB" eight-hour constant-potential battery-charging outfit and the new "HB" 300-amp., 7½-15-volt outfit.

New Incorporations

THE ATKINS LIGHT & POWER COMPANY, Marion, Va., has been incorporated with a capital stock of $10,000. The officers are: C. P. Shrock, president, and S. T. Crowe, secretary.

THE GLENVILLE (W. VA.) ELECTRIC COMPANY has been incorporated by C. W. Marsh, W. T. Smith, B. W. Craddock, Guy Stalnaker, J. Craddock and G. Smith, all of Glenville. The company is capitalized at $15,000 and proposes to supply electricity for lamps and motors in Glenville.

THE FARMINGTON RIVER HYDRO-ELECTRIC CORPORATION has filed articles of incorporation under the laws of the State of Delaware for the purpose of constructing two hydro-electric plants on the Farmington River. The officers are: L. B. Dow, New Boston, Conn., president; H. W. Ward, vice-president, and R. P. Ward, secretary and treasurer.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

CALAIS, ME. — The Hollingsworth & Whitney Company, 185 Devonshire Street, Boston plans to build a power plant in connection with its proposed local paper mill, to cost about $250,000.

PORTLAND, ME.—The Portland Terminal Company, a subsidiary of the Maine Central Railway Company, plans to build a power house in connection with its proposed car repair shops at South Portland, to cost about $1,500,000.

BOSTON, MASS.—Plans have been prepared by the Department of Public Works for a new fire-signal station to be erected on Boylston Street and also for changing the fire-alarm system throughout the city. The cost is estimated at about $500,000.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is planning to install a new distributing and switching station on its Mill Street property.

WORCESTER, MASS.—The Worcester Electric Light Company plans to place about 3 miles of its overhead wires underground this season in various sections of the city, in accordance with its agreement with the city.

NEW BRITAIN, CONN.—The Farmington River Power Company will soon begin work on two new hydro-electric plants on the Farmington River, near New Boston, for the Farmington River Hydro-Electric Corporation, recently organized, to supply electricity in this section of the state. One development will include three dams, reservoirs and a 4,000-hp. plant to operate under a 300-ft. head, and the other a dam, pipe line and power station of 3,600 hp. operating under a 150-ft. head. The proposed plant will supply energy in New Hartford and vicinity. L. B. Dow, New Boston, is president.

SOUTH NORWALK, CONN.—Plans are being prepared by Westcott & Mapes, Inc., New Haven, architect and engineer, for an addition to the municipal lighting plant, to cost about $300,000.

Middle Atlantic States

AMSTERDAM, N. Y.—The Adirondack Power & Light Corporation contemplates the erection of a high-tension transmission line from the Rotterdam distribution station to North Albany substation (18 miles), to cost $23,500 per mile.

MEDINA, N. Y.—The Western New York Utilities Company, Inc., expects to install a General Electric 3,200-kva., three-phase, 25-cycle, 115,000-volt vertical unit at its Waterport plant. G. W. Ide is manager.

NEW YORK, N. Y.—The United Electric Light & Power Company is taking bids for an addition to its Hell Gate electric plant.

ROCHESTER, N. Y.—Extensions and improvements are contemplated by the Rochester Gas & Electric Company during 1923, including a new substation and equipment in congested district, substation and equipment at western city line for industrial district, enlarging main steam station No. 3, and installing one 15,000-kw. turbine, new switchboard and other equipment, and extension to distribution and transmission systems. The cost is estimated at $3,060,477. Thomas H. Yawger is general superintendent.

ROME, N. Y.—Electric power equipment will be installed in the proposed addition to the plant of the Rome Brass & Copper Company, to cost about $175,000. A. F. Pashley, 431 South Dearborn Street, Chicago, is architect.

LAKEWOOD, N. J.—The Lakewood & Coast Electric Company contemplates extensions and improvements to its system.

ANNVILLE, PA.—The Annville & Palmyra Electric Light Company plans to rebuild all secondary lines in Palmyra. D. K. Bomberger is manager.

BETHLEHEM, PA. — Electric power equipment will be installed in the new five-story cold-storage, refrigerating and packing plant to be built by the Confederated Home Abattoirs Corporation, 314 American Casualty Building, for which bids will be received until May 15.

COLFAX, PA.—The Duquesne Light Company, Pittsburgh, is taking bids for the construction of an addition to its local generating plant, to cost about $500,000.

GIRARDVILLE, PA. — Extensions and improvements are contemplated by the Schuylkill Electric Company, including the construction of a 1,000-kw. substation (direct current) for railway service for the Schuylkill Railway Company, the installation of 120 series street lamps in West Mahoney Township and 25 series street lamps in Butler Township. Transmission voltage will be changed from 2,300 to 6,600 volts to Centralia and Lost Creek. Two outdoor substations, one of 400 kva. and the other 300 kva., will be erected. Emery Stern is electrical engineer.

HARRISBURG, PA.—The Harrisburg Light & Power Company plans extensions and improvements to its system to cost $700,000.

MIDDLETOWN, PA.—Officials of the Metropolitan-Edison Company, Reading, have organized the Metropolitan Power Company to construct and operate the steam-driven electric plant to be built on the Susquehanna River here. The first unit will have a capacity of 30,000 kw. and will cost about $1,000,000. The cost of the entire project is estimated at $3,000,000.

PHILADELPHIA, PA.—A power house will be erected at the plant of the Modern Laundry Company, Forty-first and Filbert Streets. William Lowenthal, 1208 Chestnut Street, is architect.

PHILADELPHIA, PA.—Bids will be received by the Department of Public Works, City Hall, until April 25, for electrical equipment for the Northeast Sewerage Treatment Works.

PHILADELPHIA, PA.—Electric power equipment will be installed in the proposed plant to be erected at Water and Bainbridge Streets by the American Bag & Paper Company, Second and Vine Streets, to cost about $550,000.

READING, PA.—Plans are under way for the installation of electric pumping ma-

chinery in connection with a proposed filter plant at the municipal waterworks.

SPARTANSBURG, PA.—The Spartansburg Oil & Gas Company, plans to build a substation at its proposed local oil refinery, to cost about $130,000.

SPRINGDALE, PA. — Electric power equipment will be installed in the proposed addition to the plant of the Heidenkamp Plate Glass Corporation, to cost about $500,000.

BALTIMORE, MD.—The Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, Pa., will build a power house in connection with its proposed plant, on Fifth Avenue, to cost $2,000,000.

BECKLEY, W. VA.—The Beckley Electric Light & Power Company contemplates the installation of an ornamental lighting system in the business district (about sixty lamps), erecting a new office building on Heber Street and purchasing a new compressor for the water plant. Charles C. Farmer is secretary.

MARTINSBURG, W. VA.—The United Steel & Car Company, recently organized, will build a power house at its proposed local plant, to cost about $1,000,000. F. Vernon Aler represents the company.

SUMMERSVILLE, W. VA.—W. H. Campbell & Son, owners of the local electric plant, contemplate the construction of a new electric plant. As yet details have not been decided upon.

FRANKLIN, VA.—A 13,000-volt transmission line is now being erected from the municipal electric plant to the town of Boykins, a distance of 21 miles. J. B. Lynch is superintendent of distribution.

NEWPORT, VA.—The Chesapeake & Ohio Railroad Company contemplates building a power plant in connection with its proposed locomotive and car repair shops, to cost $750,000. C. W. Johns, Richmond, is chief engineer.

YORKTOWN, VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will soon take bids for the installation of equipment at the local power plant (Specification 4,826).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, until April 23, for 150 switch assemblies and 150 switch panel assemblies (Circular 23-138).

North Central States

ALMA, MICH.—An additional 100-hp. or 150-hp. oil-engine-driven unit may be purchased for the municipal electric light plant. E. E. McKee is city clerk.

GRAND RAPIDS, MICH. — The Père Marquette Railroad Company plans to build a power plant at its Wyoming shops, to cost about $500,000.

KALAMAZOO, MICH. — Electric power equipment will be installed in the proposed addition to be erected by the Kalamazoo Paper Box Company, to cost about $200,000. Billingham & Cobb, Press Building, are architects.

LEXINGTON, MICH.—Plans are under consideration to connect the municipal system with the lines of the Great Lakes Power Company, Sault Ste. Marie, Ontario, Canada. W. Hatton is manager.

ZILWAUKEE, MICH.—The Consumers' Power Company, Jackson, has surveys in progress for its proposed 100,000-hp. steam-driven electric plant. The cost is estimated at $500,000.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, until April 27 for distributing transformers for the division of light and power.

TORONTO, OHIO.—The Ohio & Pennsylvania Power Company contemplates building a power plant here to cost about $1,000,000. A transmission line will be erected.

LOUISVILLE, KY.—The Louisville Gas & Electric Company contemplates erecting a substation at Thirteenth and Magazine Streets, to cost about $150,000.

EVANSVILLE, IND.—Plans for the proposed local car and locomotive shops of the Chicago & Eastern Illinois Railroad Company include a power house. The cost is estimated at $1,000,000.

INDIANAPOLIS, IND. — Bids will be received by the Board of Sanitary Commissioners, Sanitary District of Indianapolis, City Hall, until April 24 for construction of dehydration building and furnishing equipment of section 5, division III, for the sewage-disposal plant, including electric wiring, stokers, coal storage and handling equipment, conveyors, fans and motors, traveling cranes, etc. Charles H. Hurd, Merchants' Bank Building, is consulting engineer.

VINCENNES, IND.—The Blackford Window Glass Company plans to build a power house at its new local plant, to cost about $1,000,000.

DURAND, WIS. — The Durand Light & Power Company is planning to raise its power dam at Eau Galle.

GALESVILLE, WIS.—The Davis Mill & Electric Company contemplates erecting some farmer lines this year. B. W. Davis is manager.

GREEN BAY, WIS. — The Wisconsin Public Service Corporation plans to start work on another large hydroelectric development at Caldron Falls on the Peshtigo River, to cost about $750,000.

IRON RIVER, WIS. — The Iron River Light & Power Company contemplates building a new hydro-electric plant this year, to cost about $400,000.

MENASHA, WIS.—The Municipal Electric and Water Department contemplates the purchase of equipment for changing the distribution lines from 2,300, delta, three-phase, to 2,300/4,000 star, three-phase, fireproofing plant building and installing additional water-pumping machinery. J. H. Kuester is superintendent of distribution.

LITTLE FALLS, MINN. — Plans have been prepared by the Little Falls Power Company for a hydro-electric development in the Mississippi River, to cost about $100,000. The project will include two dams and power house.

CEDAR ROCK, IOWA.—The Iowa Electric Company has been granted a franchise to erect a hydro-electric plant on the Wapsipinicon River, near Big Rock, this summer.

FORT DODGE, IOWA.—The Fort Dodge Gas & Electric Company contemplates replacing all gas lamps with electric lamps during the year. M. Anderson is manager.

MUSCATINE, IOWA. — The date for receiving bids for the construction of the municipal electric plant and distribution system has been extended from April 18 to April 25 by the board of electric light trustees. A. I. Mullergren, Gates Building, Kansas City, Mo., is consulting engineer.

NEOLA, IOWA.—The installation of an additional generating unit in the municipal electric light plant and establishing a twenty-four hour service is under consideration. E. L. Stinn is superintendent.

HOUSTON, MO.—The Houston Electric Light & Power Company expects to build a new dam and will probably install a new waterwheel and repair transmission lines. J. A. Johnston is president.

JASPER, MO.—Bonds to the amount of $40,000 have been voted for the installation of a municipal electric plant and waterworks.

LANAGAN, MO. — The Indian River Power Company will erect a transmission line to furnish electricity to the Elk Springs, Ginger Blue Lodge and Kansas City (Kan.) Boy Scouts' Camp. William Christensen is superintendent.

GRAND FORKS, N. D.—The Red River Power Company contemplates the erection of about 28 miles of transmission lines, to cost about $30,000.

STARKWEATHER, N. D.—The Northern Utilities Corporation contemplates the installation of a large fuel-oil storage tank. F. R. Irons is manager.

VALENTINE, NEB.—The Cornell Hydro Electric Company is considering the installation of an oil engine (stand-by) unit. P. S. Hyatt is manager.

EUREKA, KAN.—Bids will be received by the city clerk until April 24, for the installation of an ornamental lighting system.

KANSAS CITY, KAN. — The Atchison, Topeka & Santa Fe Railway Company, Chicago, plans to build a power house in connection with its proposed local locomotive and car shops, to cost about $300,000.

KANSAS CITY, KAN.—Electric power equipment will be installed in the oil-refining plant to be erected by the Sinclair Refining Company, 111 West Washington Street, Chicago, to cost about $500,000.

WICHITA, KAN. — The Roxana (Ill.) Petroleum Company, will build a power house in connection with its proposed local refining plant, to cost about $3,500,000.

Southern States

BOONE, N. C. — An electric generator, switchboard and other equipment will be installed at the power house at the Appalachian Training School.

CARTHAGE, N. C.—Surveys are being made by the Smitherton Power Company, Troy, for proposed power development and dams on Drowning Creek, Moore County. The company will ultimately build a cotton mill on the creek.

DANBURY, N. C.—Pepper Brothers contemplate building a hydro-electric plant in connection with a new grain mill, to cost about $90,000.

MOORSEVILLE, N. C.—Bids will be received by the Mayor and Board of Town Commissioners until May 7 for improvements to waterworks, including pumping station, auxiliary station, 5 miles of 2,200-volt transmission line, motor-driven centrifugal pumps and accessories, filter-plant equipment, etc. The Gilbert C. White Company, Durham, is engineer.

RED SPRINGS, N. C. — Bonds to the amount of $56,000 have been sold, the proceeds to be used for the installation of a lighting system and other municipal improvements.

KINGSTREE, S. C.—The Kingstree Electric Light & Ice Company will make extensions to its transmission lines and install a new oil engine this summer. F. B. Adams is manager.

EATONTON, GA.—The Putman Mills & Power Company contemplates the construction of a new power plant, to cost $70,000.

CRESCENT CITY, FLA.—Bids will be received by the Board of Bond Trustees until May 14 for the installation of a 100-hp. Diesel or semi-Diesel engine and an alternating-current generator for direct connection to engine, together with exciter and switchboards. C. H. Preston is chairman.

CLARKSVILLE, TENN.—The Kentucky Public Service Company contemplates installing equipment for emergency service. Energy to operate the local service is supplied from the Hopkinsville plant. E. H. Allen is local superintendent.

MEMPHIS, TENN.—The installation of an ornamental lighting system on Union Avenue is under consideration.

MEMPHIS, TENN.—The Memphis Power & Light Company has arranged a fund of $3,400,000 for extensions in plants and transmission system during the present year.

TREZEVANT, TENN.—The installation of an electric lighting system and waterworks, to cost about $35,000, is under consideration.

VICKSBURG, MISS. — The Arkansas Light & Power Company, Pine Bluff, Ark., has acquired the property of the Vicksburg (Miss.) Light & Traction Company. Extensions will be made to the system.

NEW ORLEANS, LA.—The Amalgamated Seaport Petroleum Company, recently formed, will build a power house at its proposed oil refinery, to cost about $1,500,000.

COMANCHE, OKLA.—Plans are under consideration for extending the high-tension transmission line of the municipal electric plant to three small refineries in the near future. E. A. Wine is superintendent.

FAIRFAX, OKLA.—C. I. Huffaker, owner of the local electric plant, expects to install a 300-hp. Fairbanks-Morse & Company engine and generator within the next four months.

PONCA CITY, OKLA. — Bonds to the amount of $140,000 have been voted for extensions to the municipal electric light plant.

SAND SPRINGS, OKLA.—A power plant will be built by the Consumers' Ice Company in connection with a new ice-manufacturing plant, to cost about $75,000.

BRONTE, TEX.—The City Council has granted C. Holder and F. E. Brown a franchise to construct and operate an electric lighting system here.

BURKBURNETT, TEX.—The Burkburnett Electric Company, recently acquired by new interests, contemplates extensions to its system.

COOPER, TEX. — The Cooper Power, Light & Ice Company contemplates rebuilding its distribution lines. E. D. Brodhead is president and manager.

HEMPSTEAD, TEX.—The Western Public Service Company, Colorado Springs, Col., has acquired the property of the Hempstead Light & Power Company and will make extensions and improvements.

FORT WORTH, TEX.—A power plant will be built by the Southwestern Portland Cement Company, El Paso, at its proposed local mill, to cost about $450,000.

JASPER, TEX. — The Jasper Electric Company is planning to install an additional generating unit. Wesley L. Neal is manager.

KERRVILLE, TEX.—The Kerrville Light, Heat & Power Company contemplates installing an oil or Diesel engine-driven unit of about 250 hp., complete with generator and switchboard. S. Eastland is president of the company.

LOCKHART, TEX.—The Citizens' Light & Water Company is considering the construction of an ice plant.

Pacific and Mountain States

MILLWOOD, WASH.—The Inland Empire Paper Company contemplates extensions to its plant, including the construction of a dam on the Spokane River, to develop power to operate its works.

STAYTON, ORE.—A. D. Gardner has applied for permission to construct a hydro-electric power plant to furnish electricity to a number of local industries.

LONG BEACH, CAL.—Steps have been taken for the installation of an ornamental lighting system on Belmont Avenue.

LOS ANGELES, CAL.—The construction of an automatic power station, 45 ft. x 40 ft., is under consideration by the Los Angeles Railway Corporation.

MODESTO, CAL.—Bids will be received at the office of the Modesto Irrigation District, Modesto, until May 2, for material required in building an electric distribution system within the district. The apparatus to be purchased will include 900 butt-treated poles, hardware for approximately 40 miles of line, 139,500 lb. of copper wire, nine three-pole, 11-kv. switches, four 1,000-kva. and six 160-kva. transformers.

RIVERSIDE, CAL.—The Snowolene Refining Company, Pacific Mutual Building, Los Angeles, plans to build a power house in connection with its proposed oil-refining plant, to cost about $350,000.

SAN FRANCISCO, CAL.—The Electric Metals Company, care of Sanderson & Porter, Nevada Bank Building, consulting engineers, is preparing plants for a 100,000-hp. hydro-electric generating plant on the Klamath River, Siskiyou County, in connection with a metallurgical plant, to cost about $800,000.

SANTA BARBARA, CAL. — Plans are being prepared by Soule, Murphy & Hastings, 1206 State Street, for an orphanage, power house and laundry, to cost about $250,000, for the St. Vincent's Orphanage.

TURLOCK, CAL.—Steps are being taken for the installation of an ornamental street-lighting system. Horace Hall is city engineer.

VENTURA, CAL.—The Seaside Refinery Company will build a substation in connection with a new oil refinery, to cost about $100,000.

ISMAY, MONT. — The Ismay Light & Telephone Company contemplates increasing the output of its plant. Clifford Sweet is manager.

Canada

BOTHWELL, ONT.—The Lighting Commissioners contemplate a general overhauling of the municipal electric system and installation of new transformers and erecting new wire. E. H. Crompton is secretary.

ORILLA, ONT.—The Water, Light and Power Commission contemplates installing approximately 300 additional street lamps in the town and suburbs and erecting a substation at Atherly. A 2,200-volt line is being erected to Victoria Point. R. H. Starr is chief engineer.

PETERBOROUGH, ONT.—The Peterborough Utilities Commission expects to erect a new main substation this year, to cost about $150,000. W. G. Henderson is secretary.

PORT STANLEY, ONT.—The construction of a steam-power plant at Port Stanley, to cost about $1,000,000 is under consideration by the Hydro-Electric Commission of Ontario.

STURGEON FALLS, ONT.—The Municipal Electric Light Department contemplates changing the street-lighting system from 4.4 amp. series lamps to 6.6-amp. series lamps with constant-load transformers, and also erecting a three-phase circuit throughout the town for power service. L. E. Carter is town engineer.

COATICOOK, QUE.—The Town Council contemplates a 1,200-hp. development under a 90-ft. head this summer. The project will include the construction of a power house and the purchase of electric generating equipment and waterwheel. E. E. Akhurst is superintendent.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 20, 1923)

1,449,784. INDUCTION-MOTOR SPEED REGULATION; W. Seiz, Baden, Switzerland. App. filed March 3, 1921. Commutator machine in concatenation with induction-motor secondary.

1,449,800. ELECTRICAL APPARATUS FOR MOTOR VEHICLES; L. M. Woolson, Dayton, Ohio. App. filed July 10, 1918. Mounting of motor on automobile-engine flywheel.

1,449,815. MEANS FOR CONTROLLING ELECTRIC SWITCHES; E. C. Gooch, Estes Park, Col. App. filed July 3, 1920. To prevent welding together of automatic closing devices.

1,449,825. STORAGE-BATTERY CONSTRUCTION; W. P. Loudon, Niagara Falls, N. Y. App. filed April 18, 1918. Improved venting plug.

1,449,830. CIRCUIT-CONTROLLING TELEPHONE-RECEIVER SUPPORT; D. M. Miller, Brooklyn, N. Y. App. filed March 18, 1921. Pivoted arm-holding receiver controls circuit.

1,449,833. PROCESS OF REGENERATING LEAD-STORAGE BATTERIES; H. O. Parker, Midland, Pa. App. filed Aug. 13, 1920. Battery filled with a hydroxide and then charged until solution becomes acid.

1,449,834. ROTATING OR OSCILLATING ELECTRIC FURNACE PLANT; A. H. Pehrson, Stockholm, Sweden. App. filed April 11, 1922.

1,449,852. ELECTROMAGNETIC APPARATUS; C. A. Cadwell, Cleveland, Ohio. App. filed Nov. 25, 1916. Device to regulate and control electrodes of welding apparatus.

1,449,861. FURNACE REGULATOR SYSTEM; H. King, Wilkinsburg, Pa. App. filed Dec. 13, 1919. Automatic regulation of electrodes.

1,449,863. TWO-PHASE HIGH-FREQUENCY ELECTRIC ALTERNATING-CURRENT GENERATOR; M. C. A. Latour, London, England. App. filed June 23, 1920. Homopolar alternator for wireless telephony and telegraphy.

(Issued March 27, 1923)

1,449,871. MODULATOR; J. B. Pratt, Schenectady, N. Y. App. filed Jan. 12, 1922. High frequency current magnetic amplifier.

1,449,878. MODULATOR; E. Austin, Schenectady, N. Y. App. filed Jan. 12, 1922. Magnetic modulator to control amplitude of antenna current.

1,449,879. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed April 4, 1919. Main control electromagnet operated by current flowing through furnace.

1,449,880. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Regulator for operating electrode motor in accordance with voltage and current conditions of supply circuit.

1,449,881. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Regulator governs operation of movable electrodes to maintain equal heating effects.

1,449,882. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed June 25, 1919. Automatic regulator prevents hunting section of electrodes.

1,449,883. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Automatic regulation of movable electrodes.

1,449,884. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Electrode movement controlled by current passing through it.

1,449,885. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Aug. 26, 1919. Two electrically operated switches control electrodes.

1,449,886. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Oct. 2, 1919. Electrode regulator controlled by amount of currents passing through electrode.

1,449,887. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 13, 1919. Governs operation of movable electrodes.

1,449,888. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Dec. 3, 1919. Two differential windings selectively energized to change setting of main magnet of electrode regulator.

1,449,889. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Dec. 3, 1919. Electrode regulator comprises a main control having a main and an auxiliary electromagnet and two switches.

1,449,890. FURNACE REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed April 14, 1920. Current electrode controlled in accordance with potential across supply circuit.

1,449,896. FURNACE REGULATOR SYSTEM; R. D. Evans, Wilkinsburg, Pa. App. filed Oct. 16, 1918. Separate motor for raising and lowering each movable electrode.

1,449,897. ELECTRIC FURNACE REGULATOR SYSTEM; R. D. Evans, Wilkinsburg, Pa. App. filed April 9, 1919. Automatic control of electrodes.

1,449,898. COIL-WINDING MACHINE; C. Fayer, New York, N. Y. App. filed Jan. 4, 1921. For winding coils used for producing high-tension currents, impulses and discharges such as X-ray machines.

1,449,904. TELEPHONE TRANSPORTATION SWITCHING BOX; E. Love, Prince Rupert, B. C., Canada. App. filed Aug. 22, 1921. For transposing long-distance telephone lines.

1,449,908. ELECTRIC VALVE GRINDER; J. J. McGuckin and John Peyer, Brooklyn, N. Y. App. filed April 2, 1921. For internal-combustion engines.

1,449,911. METHOD AND MEANS OF RECEIVING SIGNALS; R. H. Ranger, Brooklyn, N. Y. App. filed Nov. 12, 1921. Signal recorded by several stations and wave form compared to secure original signal sent out.

1,449,919. NON-INDUCTIVE INTERFERENCE SYSTEM; J. Slepian, Wilkinsburg, Pa. App. filed March 8, 1919. Counteracting any induced voltage by impressing equal and opposite voltage on line.

1,449,970. PLATE HOLDER FOR TAKING RÖNTGEN PHOTOGRAPHS; G. Bucky, Berlin, Germany. App. filed Jan. 20, 1921.

1,449,982. SELF-WINDING CLOCK; J. T. A. Gaucher (deceased), late of Montreal, Que., Canada. App. filed June 26, 1920. Electrically wound.

1,449,984. ALTERNATING CURRENT LOCAL CIRCUITS FOR CODE SIGNALING TELEGRAPHS; J. J. Ghegan, East Orange, N. J. App. filed April 8, 1919.

1,449,985. AUXILIARY DEVICE FOR TELEGRAPH KEYS; J. J. Ghegan, East Orange, N. J. App. filed July 10, 1919. Increased speed in transmitting possible.

1,449,987. STATIC POTENTIAL-CONTROLLING APPARATUS; R. M. Gilson, Pittsburgh, Pa. App. filed June 4, 1919. Series-circuit lamp contact.

1,449,991. METHOD OF AND MEANS FOR COUNTERACTING DESTRUCTIVE ELECTROLYSIS; L. O. Gunderson, Decatur, Ill. App. filed Nov. 4, 1921. Electrolysis in steam boiler neutralized by a secondary cathode.

1,450,002. ELECTRIC CONNECTOR; J. Lofgren and A. R. Ayers, Chicago, Ill. App. filed June 28, 1919. Especially adaptable for use on locomotives.

1,450,004. ELECTRODE ELEMENT FOR GALVANIC BATTERIES AND METHOD OF PRODUCING SAME; M. L. Martus, Woodbury, Conn. App. filed Feb. 8, 1922.

1,450,022. REFLECTING HEAT APPLIANCE; J. E. Doyle, Cleveland, Ohio. App. filed Oct. 15, 1921. Drying printed paper as it passes through press.

1,450,025. SAFETY X-RAY APPARATUS; E. L. Edwards and F. A. Farwell, Indianapolis, Ind. App. filed Nov. 6, 1920. Inclosure for high-tension transformer.

1,450,038. COMBINED WAVE CHANGER AND WAVE METER; G. Hill, Washington, D. C. App. filed April 28, 1920. For determining wave length of wireless receiving set at all times.

1,450,043. PRIMARY BATTERY; M. L. Martus, Woodbury, and J. G. Ross and E. H. Becker, Waterbury, Conn. App. filed Oct. 24, 1921. Zinc electrode with annual rib on its outer surface.

1,450,046. SWITCH COVER AND SUPPORT; W. J. Newton, Bridgeport, Conn. App. filed Jan. 13, 1920. For automobile lighting and ignition systems.

1,450,057. TROLLEY SWITCH; A. Zimmerman, Ansted, W. Va. App. filed Jan. 12, 1922. Section insulator.

1,450,059. PRIMARY BATTERY; E. H. Becker, Waterbury, Conn. App. filed Nov. 18, 1921. Indicating apparatus attached to battery shows state of exhaustion.

1,450,061. OPTICAL METHOD FOR PRODUCING PULSATING ELECTRIC CURRENT; W. W. Coblentz, Washington, D. C. App. filed Aug. 6, 1920.

1,450,080. METHOD AND ELECTRIC CIRCUIT ARRANGEMENT FOR NEUTRALIZING CAPACITY COUPLING; L. A. Hazeltine, Hoboken, N. J. App. filed Aug. 7, 1919. Prevents the transmitting of undesirable disturbances from one circuit to another.

1,450,141. SUPPORT FOR ELECTRIC CURRENT COLLECTOR SHOES; E. A. Davis, Harvey, Ill. App. filed April 30, 1921. For traveling cranes.